HUGHEY & PHILLIPS, LLC.

Installation and Operation Guide

FLASHGUARD 2000B

FLASHGUARD 3000B

120/240/480, 50/60HZ

MEDIUM INTENSITY WHITE, RED AND DUAL LIGHTING SYSTEMS

EPM-00000002-001

Revision D

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REVISIONS

REV	DATE	ECO	COMMENT
A	4/21/04	3871	Initial Issue
B	5/14/04	4242	Add spare Flashhead o-rings to spare parts list, page 48.
C	9/17/08		Updated document formatting, table of content, list of figures, Figure 3, Figure 6, Added Figure 9 -13, Updated Section 7.0 Part List, GPS system installation
D	4/1/10		Company Name Change

TABLE OF FLASH GUARD STANDARD SYSTEMS

FG2000B SYSTEMS ARE SINGLE RED NIGHT ONLY OR WHITE DAY/NIGHT

FG3000B SYSTEMS ARE DUAL NIGHT AND DAY

MODEL NUMBER	INPUT VOLTAGE	Hz.	POWER SUPPLY P/N	FLASH HEAD P/N
FG2000B-004	120/240VAC	60	40000681-023	*277-5047W (white)
FG2001B-004	240/480VAC	50	40000681-021	*277-5047W (white)
FG2002B-004	240/480VAC	60	40000681-024	*277-5047W (white)
FG2006B-004	240/480VAC	50	40000681-021	*277-5047R (red)
FG2007B-004	240/480VAC	60	40000681-024	*277-5047R (red)
FG2009B-004	120/240VAC	60	40000681-027	*277-5047R (red)
FG3000B-004	120/240VAC	60	40000681-033	*277-5004RW (red and white)
FG3001B-004	240/480VAC	50	40000681-031	*277-5004RW (red and white)
FG3002B-004	240/480VAC	60	40000681-034	*277-5004RW (red and white)
FG3004B-004	240/480VAC	60	40000681-035	*277-5004RW (red and white)
FG3005B-004	240/480VAC	50	40000681-032	*277-5004RW (red and white)

This manual covers the above listed systems. Manual(s) for others custom systems are available upon request.

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1.0 SAFETY AND GENERAL INFORMATION

1.1 Equipment Description

The lighting system is a capacitor discharge, xenon flash strobe light system manufactured to comply with Federal Aviation Administration (FAA) Advisory Circular 150/5345-43E. Each system consists of an omni-directional flashhead, associated power supply with integrated controls, ambient light sensor (photocell), and an interconnecting cable. System components are shown in Figures 1, 2 and 3. Modifications may be made to suit different applications.

1.2 Flashheads

1.2.1 Single Level (Red or Clear)

The flashhead, Figure 1, consists of one acrylic lens assembly (red or clear) attached to a hinged base. Included within the flashhead is the flashtube assembly, an interlock switch, trigger transformer and the terminal block where the interconnecting cable terminates.

1.2.2 Dual Level (Red and Clear)

The flashhead, Figure 2, consists of two acrylic lens assemblies (red and clear) attached to a hinged base. Included within the flashhead are the two flashtube assemblies (one for the red and one for the white), an interlock switch, two trigger transformer and the terminal block where the interconnecting cable terminates.

1.3 Power Supply

The power supply contains power control circuits (relays, fuses, switches) for both strobe and auxiliary side lights, a high-voltage circuit (power transformer, rectifiers, energy storage capacitors, discharge circuits), flash interval and timing circuits, dual monitor circuits, intensity selection controls, and a trigger generator. Also attached to (or remotely located from) the power supply is the ambient light sensor (photocell).

Optional items may include a Power Line Filter and/or alarm lockout module (K6-K7) depending on required system. Modifications may be made to suit different applications.

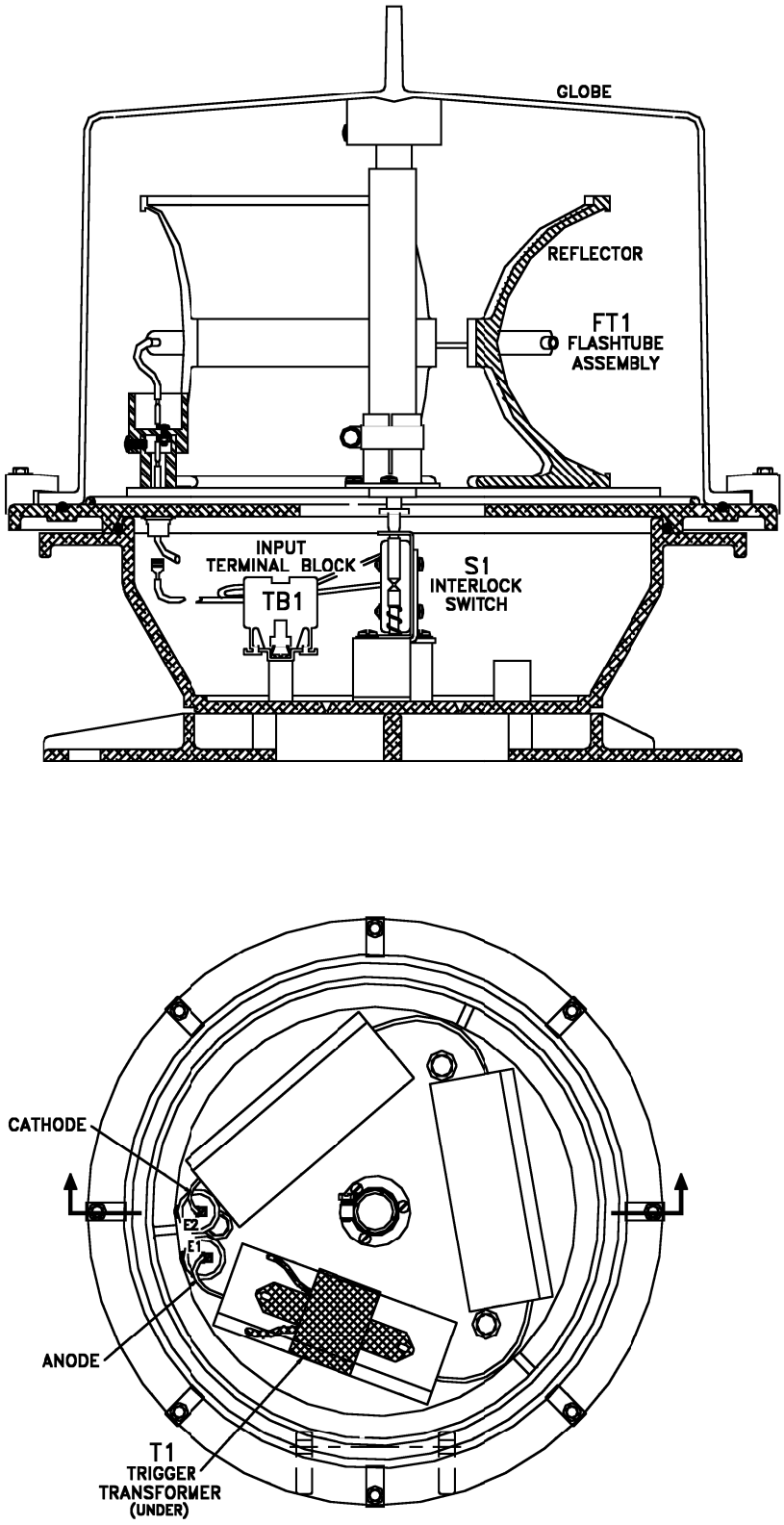

Figure 1. Single Level Flashhead

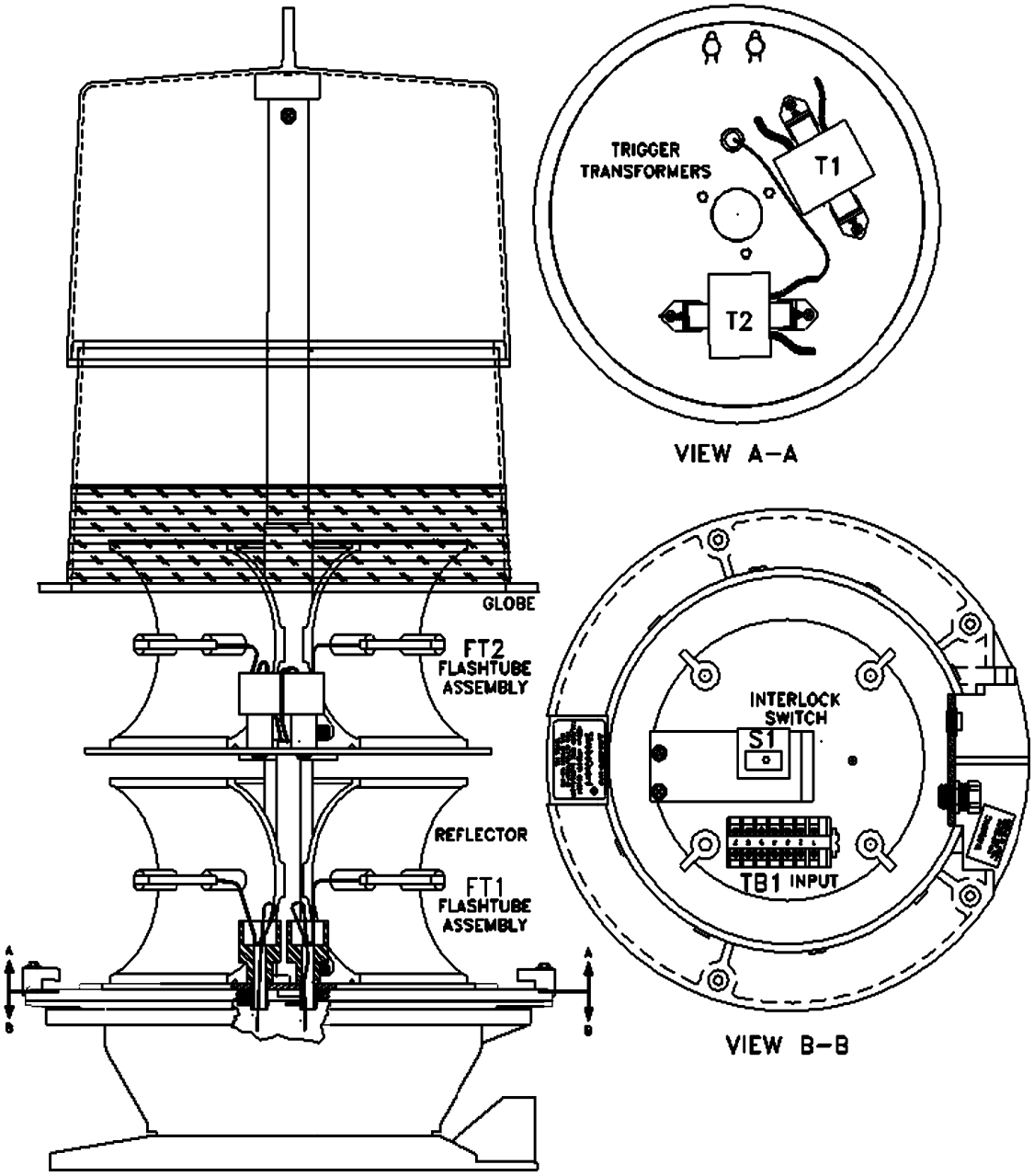

Figure 2. Dual Level Flashhead

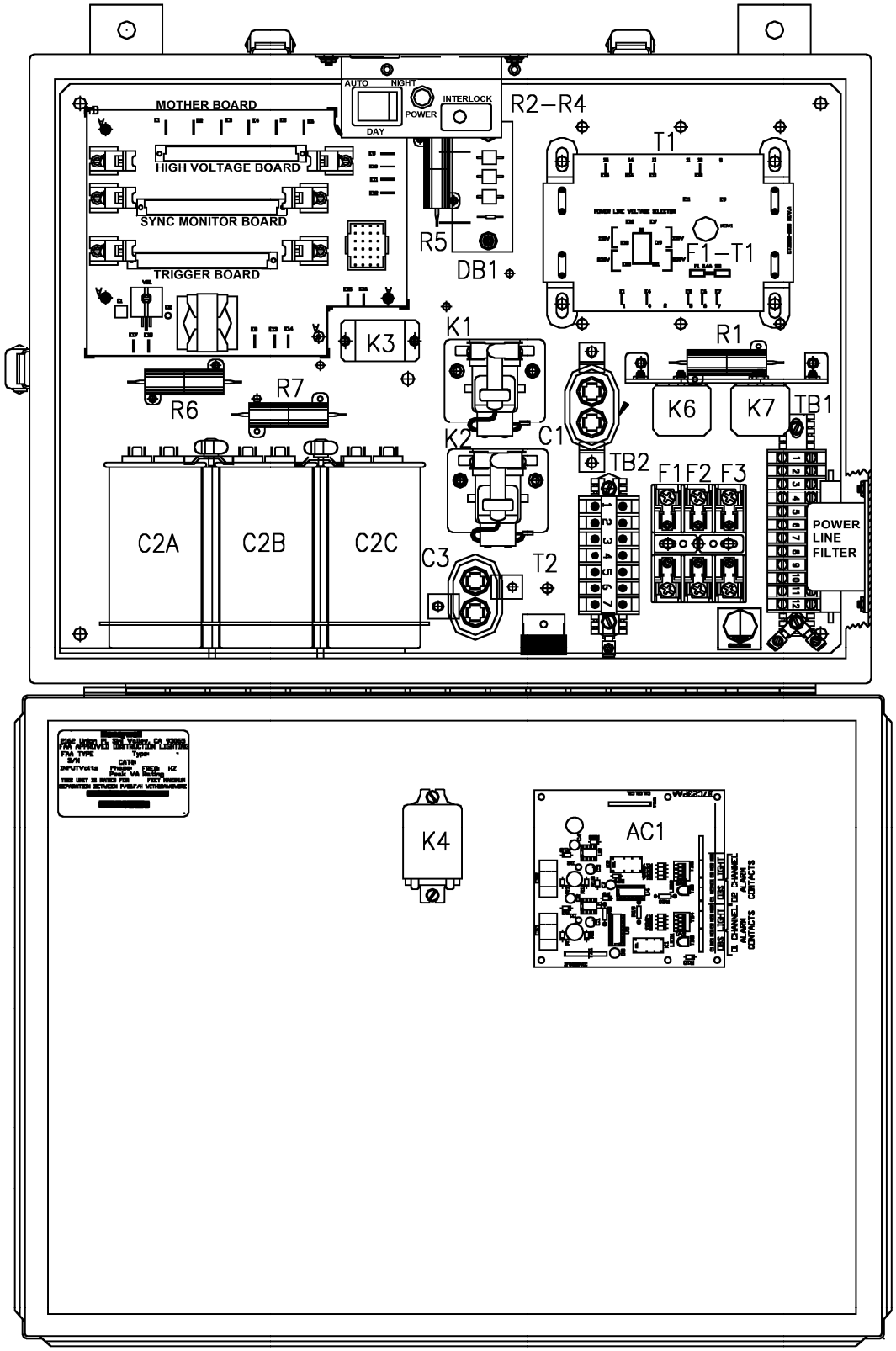

Figure 3. Lighting System Power Supply

(supplied power supply may be different)

1.4 Safety Notice

1.4.1 Voltages

The Individual control cabinet contains voltages of 1,000 VDC and constitutes a personnel safety hazard. Personnel must observe safety regulations at all times.

1.4.2 Interlocks

The Individual Control Cabinet contains interlocks for your protection. To ensure safety, always remove power from the equipment prior to opening any access panel or door. Do not depend on the interlocks or door switches for personnel protection when working with the equipment. Do not short-circuit or tamper with any access gate, door, or other safety interlock switch. Ground capacitors with a grounding rod prior to touching any component. When it is absolutely mandatory that an interlock be bypassed in order to trace a fault or correct a malfunction authorized maintenance personnel may perform the bypass for the specific test to be performed.

1.4.3 Keep Away From Live Circuits

Operating and maintenance personnel must observe all safety regulations at all times. Do not change “Plug-In” components or make adjustments inside the equipment with the high voltage power control circuits in the ON position. Under certain conditions, dangerous voltage potentials may exist in circuits with the Power Controls in the OFF position due to the charges retained by the flash capacitors. To avoid casualties, always remove the power, wait one (1) minute, and then discharge the flash capacitors, C1, C2, and C3, by touching a grounding rod to the capacitor terminals, prior to touching any component.

1.4.4 Resuscitation

Maintenance personnel shall familiarize themselves with the technique for resuscitation found in manual on First Aid Instructions.

1.4.5 Precautionary Notice for Semiconductor and Integrated Circuits

This equipment contains semiconductor devices / integrated circuits. Take the necessary ESD precautions prior to attempting any service work.

1.5 Safety Summary

The following is a summary of warnings contained within this technical manual:

WARNING!

This system uses lethal voltages in both the power supply and the flashhead. Do not attempt to service or adjust the equipment with line power applied.

Interlock switches are provided in both the flashhead and power supply enclosures to interrupt main power to the power supply. These switches are activated when the power supply door or flashhead lens assembly is opened in a conventional manner. No interlock is provided when other means of access are used. Never tamper with (remove, short circuit) the interlocks in any way.

WARNING

Line voltage is still present when interlocks are activated. Disconnect power before inspecting or servicing

WARNING

Ensure that the power is OFF and the capacitor bank has been discharged before opening the flashhead.

WARNING

Installing control boards that are incorrectly configured may cause damage and system failure.

WARNING

Lethal voltages are present in the conductors between the power supply and flashhead. There should be one continuous run of cable from flashhead to power supply. Under no circumstance should these conductors be spliced.

1.6 Electrostatic Discharge

The components inside your system are extremely sensitive to static electricity, also known as electrostatic discharge (ESD). Static electricity can cause irreparable damage to your system; however, if you follow these preventative measures and precautions, you should prevent such damage.

a) Static Electricity Prevention:

1. Wear a grounding wrist strap (available at most electronic stores).
2. Turn off the system power.
3. Unplug all cords from the wall outlet.
4. Remove the case cover.

b) Static Electricity Precautions:

1. If you're replacing or adding parts, remove the parts from their antistatic bags only when you are ready to use them. Do not lay parts on the outside of antistatic bags since only the inside provides antistatic protection.
2. Avoid static-causing surfaces, such as plastic and Styrofoam in your work area.
3. Always hold cards by their edges and their metal mounting bracket. Avoid touching components on the cards and the edge connectors that connect to expansion slots.
4. Never slide cards or other parts over any surface.

1.7 Power Tools and Hand Tools

Proper safety procedures shall be observed when using power tools or hand tools.

1.8 Maintenance Philosophy

Documentation reflects maintenance philosophy and supports equipment to this extent. Functional theory of operation and flow-charts for field troubleshooting support field maintenance. Parts listing reflect only items that can be removed or replaced by field maintenance personnel. Parts and components that are not suited for field repair or replacement are not included in the technical manual.

Refer to Table 1 for a description of the limitation of maintenance.

Refer to Table 2 for maintenance work requirements and established limitations for field and supplier.

Table 1. Limitations of Maintenance

Field	Supplier
• Periodic checks of equipment Performance. • Visual inspections • Cleaning of system elements • Servicing of specified items • Assembly/subassembly removal and replacement. • Scheduled maintenance requiring equipment disassembly and assembly (limited to major assemblies and subassemblies).	Complete overhaul, rebuilding, and performance testing of assemblies, subassemblies, and component replacement.
Note: Field maintenance is limited to removal and replacement of the following items: • Major assemblies • Predetermined subassemblies • Predetermined circuit card assemblies • Fuses • Interconnecting cables • Bulbs • Lens covers	

Table 2. Maintenance Work Requirements

Criteria	Field Maintenance	Supplier Maintenance
Done where?	At the operational site or wherever the prime equipment is located.	Specialized repair activity or manufacturer's plant.
Done by whom?	System/equipment operating personnel.	Supplier facility personnel or manufacturer's production personnel.
On whose equipment?	Using organization's system.	Equivalent Honeywell system.
Type of work accomplished?	Visual inspection Operational checkout Minor servicing External adjustments Removal and replacement of some components.	Complicated factory adjustments. Complex equipment repair and modifications. Overhaul and rebuild Detailed calibration Software maintenance (detailed modifications). Supply support

1.9 Reference Data

Refer to Table 3 for a listing of the equipment specifications.

Table 3. Equipment Specifications

Item	Specification
Light Output	
Day Intensity	20,000 ±25% effective candelas, single flash
Night Intensity	2,000 ±25% effective candelas, burst of flashes
Beam Pattern	360º horizontally; 3º min. vertically; Maximum intensity of 3% of peak @ –10°
Flash Rate	
Day	40 flashes per minute (FPM) - single white flash
Night	20–40 FPM red flash burst
Master/Slave Operation	Up to 4 slave units may share a common sync and photocell circuit
Side Lights	1 to 4 type L-810 lights steady burn night only
Electrical Input	
Power Supply	120, 240, 480 VAC 50 or 60 Hz
Side Lights	1 to 4 type L-810, 120V LED or 116 W, 120 V incandescent
Mechanical Properties	
Flashhead	
Weight	34 pounds
Dimensions (inches)	16.5 wide X 23 high
Surface area	1.98 $ft/^2$
Wind Load	105 pounds @ 150 mph
Power Supply	
Weight	65 pounds
Dimensions (inches)	21 wide X 16.5 high 10.5 deep
Operating Environment	
Temperature	–55ºC to +55ºC
Humidity	95% relative
Status Indicators	
Neon Lamps	Power line and high voltage indicators
LED	
Sync/Monitor PCB	Sync out, master (red); fault relay (green)
Trigger Control PCB	Sync line active (green); red LED on (red)
Fault	
Strobe	Relay closure, contact ratings 3 A @ 120 VAC
Incandescent/LED	Relay closure(s), contact ratings 3 A @ 120 VAC

Item	Specification
Electrical input	
GPS	
Input Power	100–132 VAC/ 50 or 60 Hz, 10 watts Max
Flash Rate Settings	
Day	40 FPM
Nite	24, 30, 40, 60 FPM
Nite Enable Input	100–132 VAC/ 50-60 Hz
Cable Length (feet)	25, 50, 100, 150, 350 available
Mechanical Properties	
Weight	3.6 pounds
Dimensions (inches)	7.374 wide X 6.25 high
Operating Environment	
Temperature	–40ºC to +55ºC
Humidity	95% relative
Status Indicators	
LED	
Green	Power On
Yellow	GPS Lock
Red (Flashing)	Sync

2.0 INSTALLATION

2.1 Unpacking

Carefully unpack each item and remove any internal packing material from the power supply and flashhead. Examine each item for obvious physical damage. Report any claims to the carrier immediately. Pertinent data such as installation drawings, schematics, interconnection drawings, and operation manuals are included in the power supply carton. The flashtube is packaged inside the flashhead.

2.2 Mounting and Preparation

2.2.1 General

This section contains detailed drawings for mounting the flashhead and power supply. See Figures 4, 5 and 6.

2.2.2 Lighting System Flashhead

Normally the flashhead is mounted at the uppermost point on the structure. It must be mounted level to assure proper light output.

2.2.2.1 Installation Recommendations for AM Towers

For AM towers, an isolation device must be used for the tower lighting system. There are three options available: Isolation transformer, tower lighting chokes, and custom isolation inductors.

For mechanical incandescent red lighting controls, isolation transformers and tower lighting chokes provide a reliable means of supplying AC power to the tower lighting control. For some AM towers, an isolation transformer may be the better choice as they provide high RF impedance between tower and ground. With either of these devices, the tower lighting control is mounted to the tower. If possible, the lighting control should not be located at a high RF current point. Isolation transformers and tower lighting chokes are not recommended for solid-state red lighting controls or for strobe lighting systems.

Custom isolation inductors are the preferred choice for solid-state red lighting controls and strobe lighting systems. Custom isolation inductors provide isolation between the tower lighting control/power supply and the tower lighting fixtures. The conductors between the tower lighting fixtures and the lighting controls are would through a copper inductor, allowing the lighting control/power supply to be mounted at ground potential. Use of the Custom Isolation Inductor provides several advantages: The lighting controls or strobe power supplies are kept out of the RF field, and can be worked on without shutting down the transmitter. Also, the lighting alarm contacts are easily available for remote monitoring.

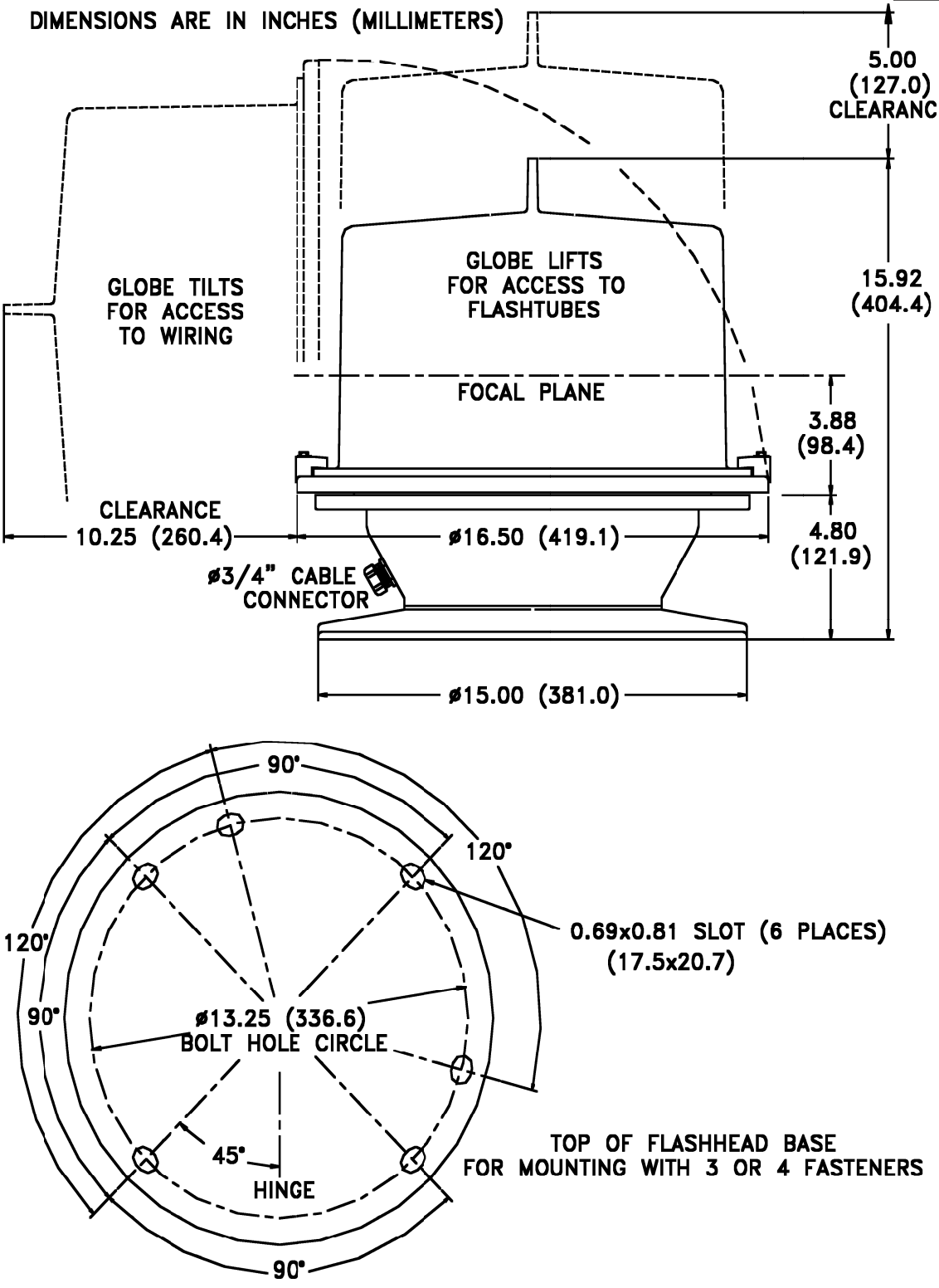

Figure 4. Single Level Flashhead Outline Drawing

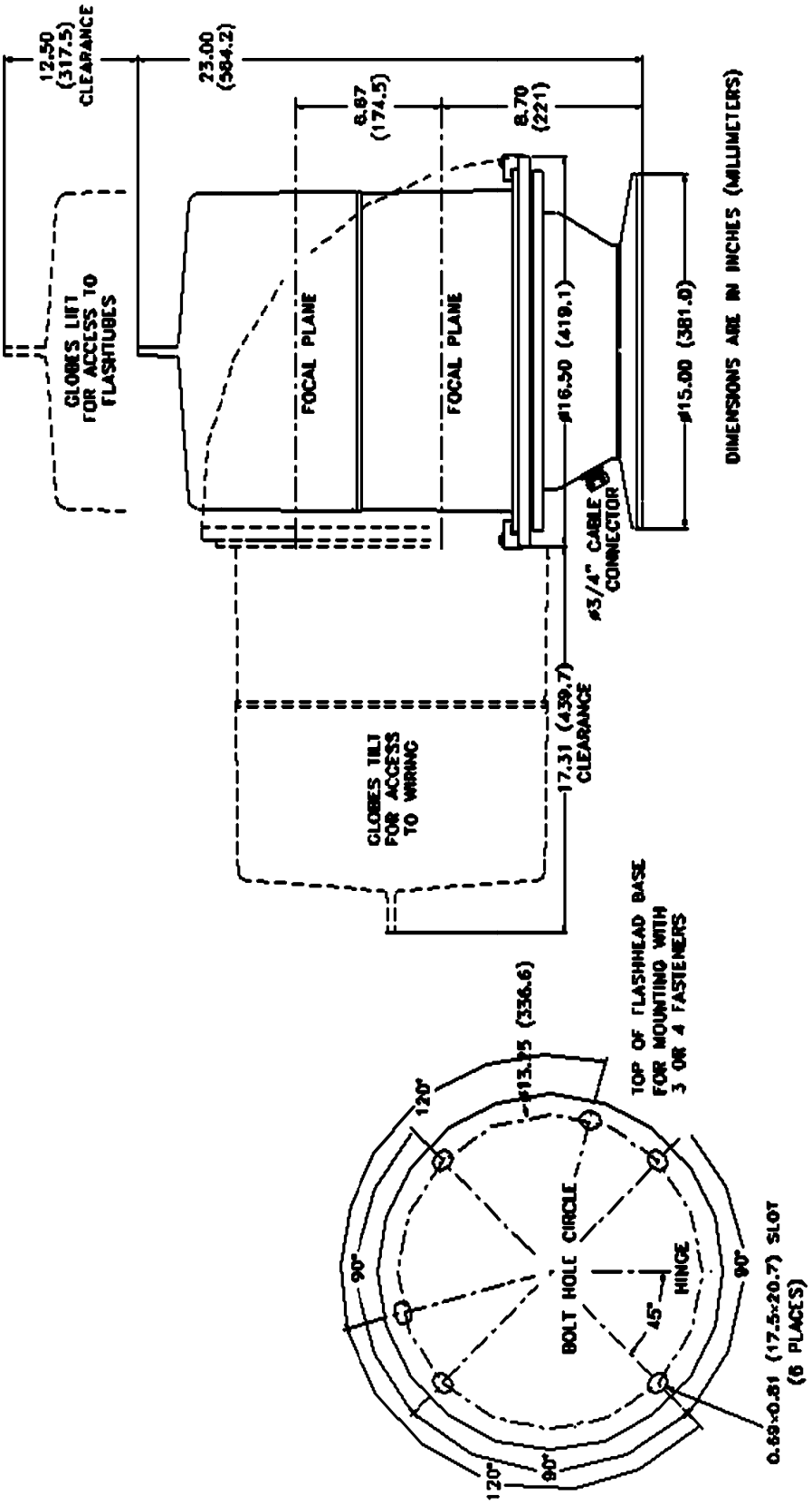

Figure 5. Dual Level Flashhead Outline Drawing

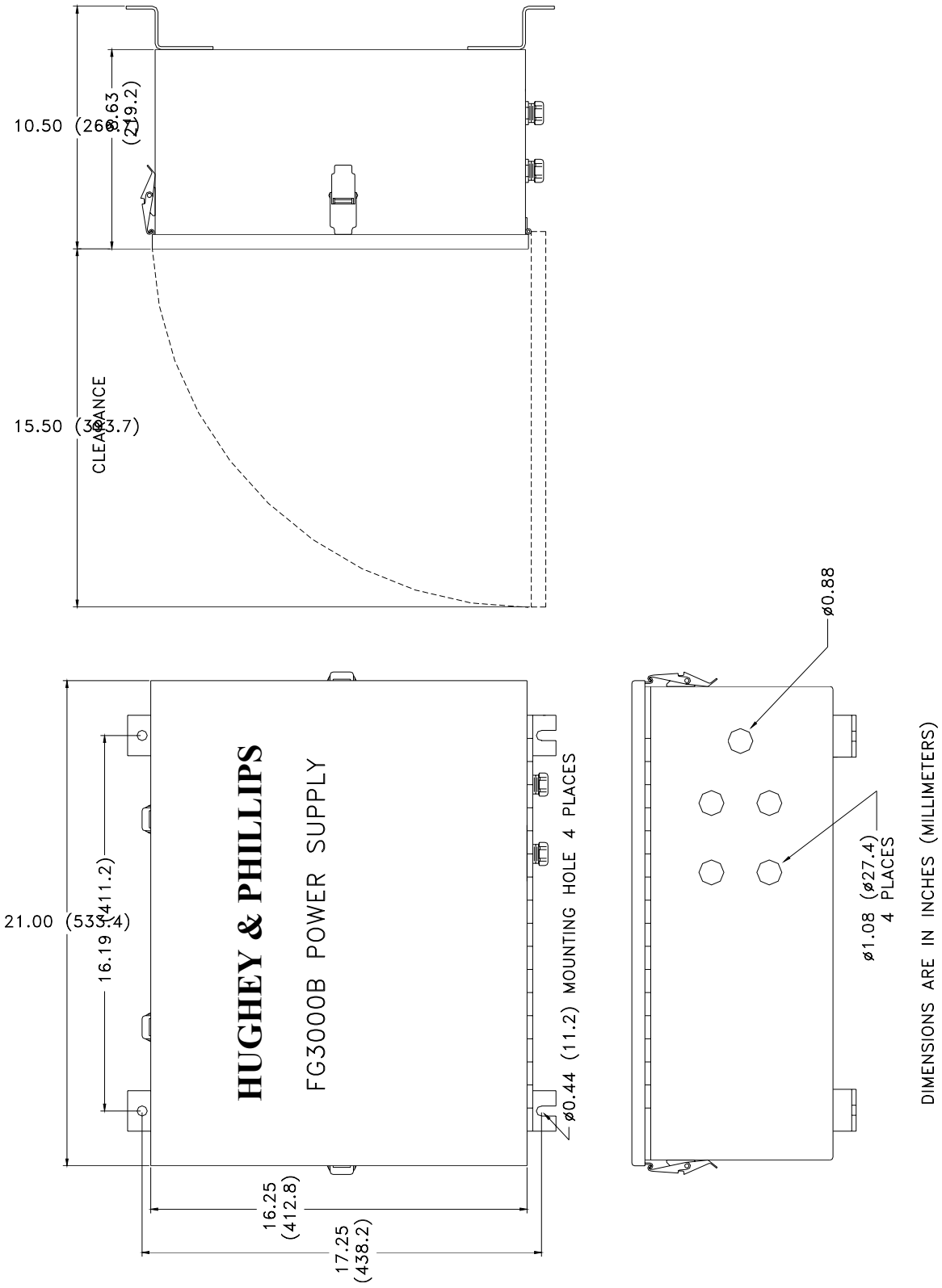

Figure 6. Lighting System Power Supply Outline Drawing

For any lighting system on AM towers, the lighting conductors or cables should be installed in galvanized steel conduit. The conduit system should be bonded to each tower section with a bonding strap. If the tower is painted, the paint should be scraped off before installing the bonding kits. After pulling the wires through the conduit system, an insulation test using a megger should be performed between every conductor-to-conductor, and between every conductor-to-conduit system. Installation Recommendations for FM towers:

WARNING

Lethal voltages are present in the conductors between the power supply and flashhead. There should be one continuous run of cable from flashhead to power supply. Under no circumstance should these conductors be spliced.

For strobe lighting systems on FM towers, care should be taken not to expose strobe cable to high FM RF fields. Generally this is done by running the strobe cable in conduit through the aperture of the FM antenna. Conduit should be installed from 15 feet below the bottom bay of the FM antenna to 15 feet above the top bay. The conduit should be bonded to the tower using a bonding kit every 5 feet. If the tower is painted, the paint should be scraped off before installing the bonding kit.

2.2.3 Lighting System Power Supply

The power supply is connected to its flashhead via the cable provided by Honeywell. The length of this cable determines how far from the flashhead the power supply can be mounted.

The user should determine that the power line voltage selector, located on the transformer board inside the power supply enclosure is set to the main voltage being used.

2.2.4 Ambient Light Sensor

The ambient light sensor, when supplied with the system, should be mounted upright, away from artificial light (e.g., floodlights), and in a location that will enable its sensor window to have an unobstructed view of the polar sky (e.g., pointed north in the Northern Hemisphere). Typical installation is done by using ½" rigid conduit and #14-AWG wire to remotely mount the photocell.

2.3 Installation Wiring

Perform the following procedures for installing interconnecting wiring (see Figure 7 for stand-alone installation and Figure 8 for master/slave installation):

a) Connect all wiring between the flashhead and the power supply using Honeywell supplied cable P/N *77-4017-4. The wires in this cable are color coded and connect to the numbered terminals of flashhead TB1 corresponding numbered terminals of the power supply TB2.

b) Connect all wiring that interconnects between the steady burning red side lights and power supply using the Honeywell supplied cable WC23012CL0T or WC23012DL0T or equivalent #12 AWG cord (color coding may be different than listed below). The wires in this cable are connected to the numbered terminals of TB1 as follows:

   1. Black Wire of Cable to TB1-11, 120VAC Line out to Sidelight Level 1
   2. Orange Wire of Cable to TB1-12, 120VAC Line out to Sidelight Level 2
   3. Red Wire of Cable to TB1-10, Neutral return from Sidelight Level(s)
   4. Blue Wire of Cable to TB1-Ground Lug

c) Connect wiring between the external photocell and the power supply using #12 AWG wire. The wires in this cable are connected from TB1, as follows:

   1. Black wire of the photocell to TB1-2
   2. Red wire of the photocell to TB1-1
   3. White wire of the photocell to TB1-Ground lug

d) For structures with 2 or more systems, connect the wiring between the master power supply and slave power supply using Honeywell cable *77-4231. This cable has a total of 10 conductors and can be used to distribute power and timing pulses and consolidates alarm functions to and from slave power supplies. For details consult Honeywell Tech Support at 805-581-5593.

2.4 GPS Sync Wiring (OPTIONAL)

Perform the following procedures for installing interconnecting wiring (see Figure 9 for System installation and Figure 10 for Power Supply internal GPS wiring installation):

a) Connect all wiring between the flashhead and the power supply using Honeywell supplied cable P/N *77-4017-4. The wires in this cable are color coded and connect to the numbered terminals of flashhead TB1 corresponding numbered terminals of the power supply TB2.

b) Connect all wiring that interconnects between the steady burning red side lights and power supply using the Honeywell supplied cable WC23012CL0T or WC23012DL0T or equivalent #12 AWG cord (color coding may be different than listed below). The wires in this cable are connected to the numbered terminals of TB1 as follows:

1. Black Wire of Cable to TB1-11, 120VAC Line out to Sidelight Level 1
2. Orange Wire of Cable to TB1-12, 120VAC Line out to Sidelight Level 2
3. Red Wire of Cable to TB1-10, Neutral return from Sidelight Level(s)
4. Blue Wire of Cable to TB1-Ground Lug

c) Connect all wiring between the GPS Sync and the power supply using Honeywell supplied cable P/N 40002074-( ) for GPS connector location (see Figure 6).

2.5 GPS Sync Installation (OPTIONAL)

The GPS (part number 40002075) unit should be mounted outdoors with a clear view of the South sky. A 25 to 350-feet GPS cable can be ordered as needed. Nearby obstructions to the South should be avoided. The unit should be mounted on a flat vertical surface or a pole (see Figure 12).

a) Switch S1-4 on the Sync/Monitor Board should be in the ON (slave) position for all GPS-controlled units.
b) Typically requires one of the following photocells (sold separately). Important: If photocell is not required, socket cover *must* be left in place to prevent water entry into GPS unit.
    1. Photocell 77-3258-001 (for Red Beacons, 35–58 fc)
    2. Photocell 77-3759-001 (for White or Dual Beacons, 1–3 fc)

WARNING

Lethal high voltages are present in the conductors between the power supply and the flashhead. There should be one continuous run of cable from flashhead to power supply. Under no circumstances should these conductors be spliced.

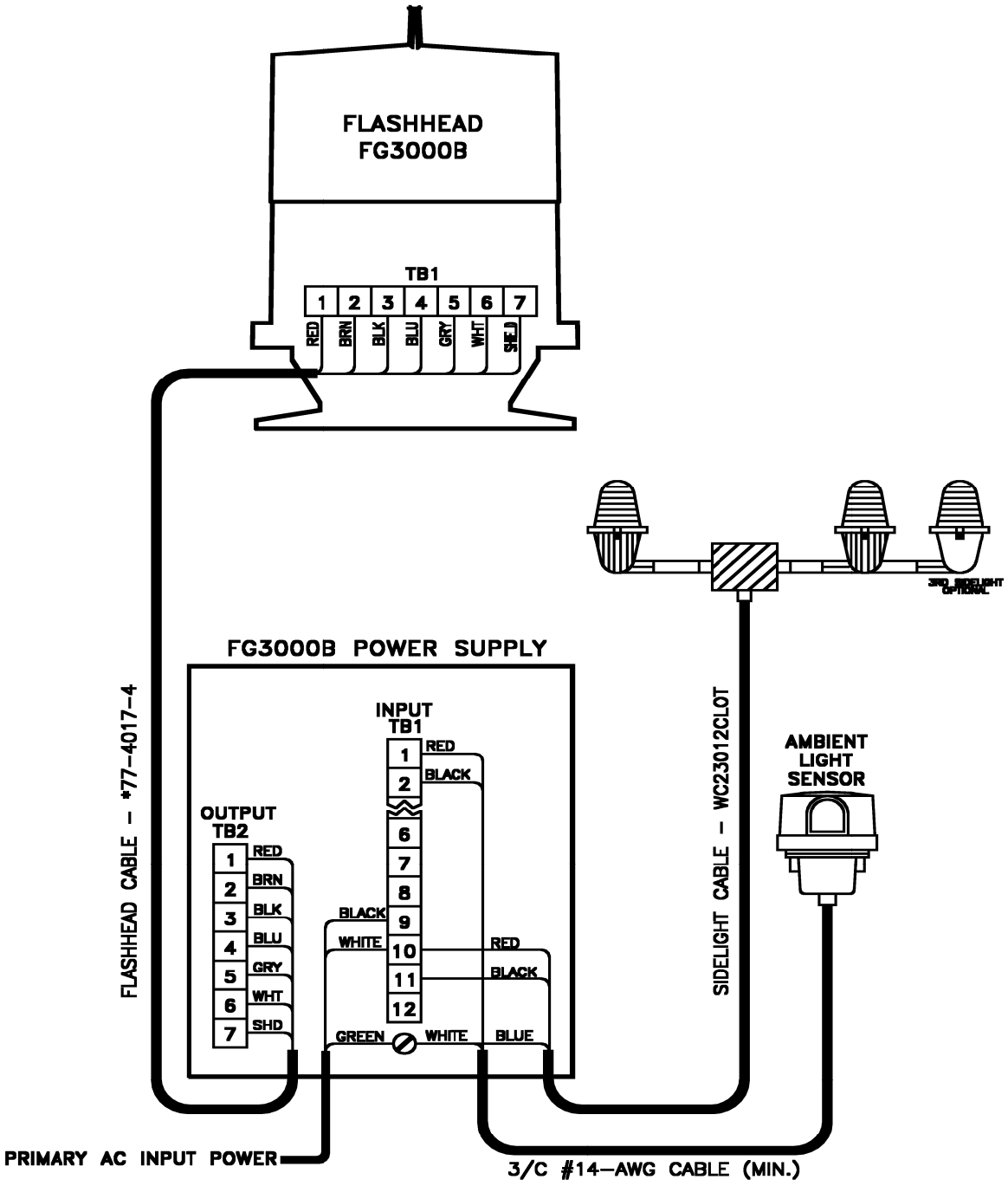

Figure 7. System Wiring Diagram

WARNING

Lethal high voltages are present in the conductors between the power supply and the flashhead. There should be one continuous run of cable from flashhead to power supply. Under no circumstances should these conductors be spliced.

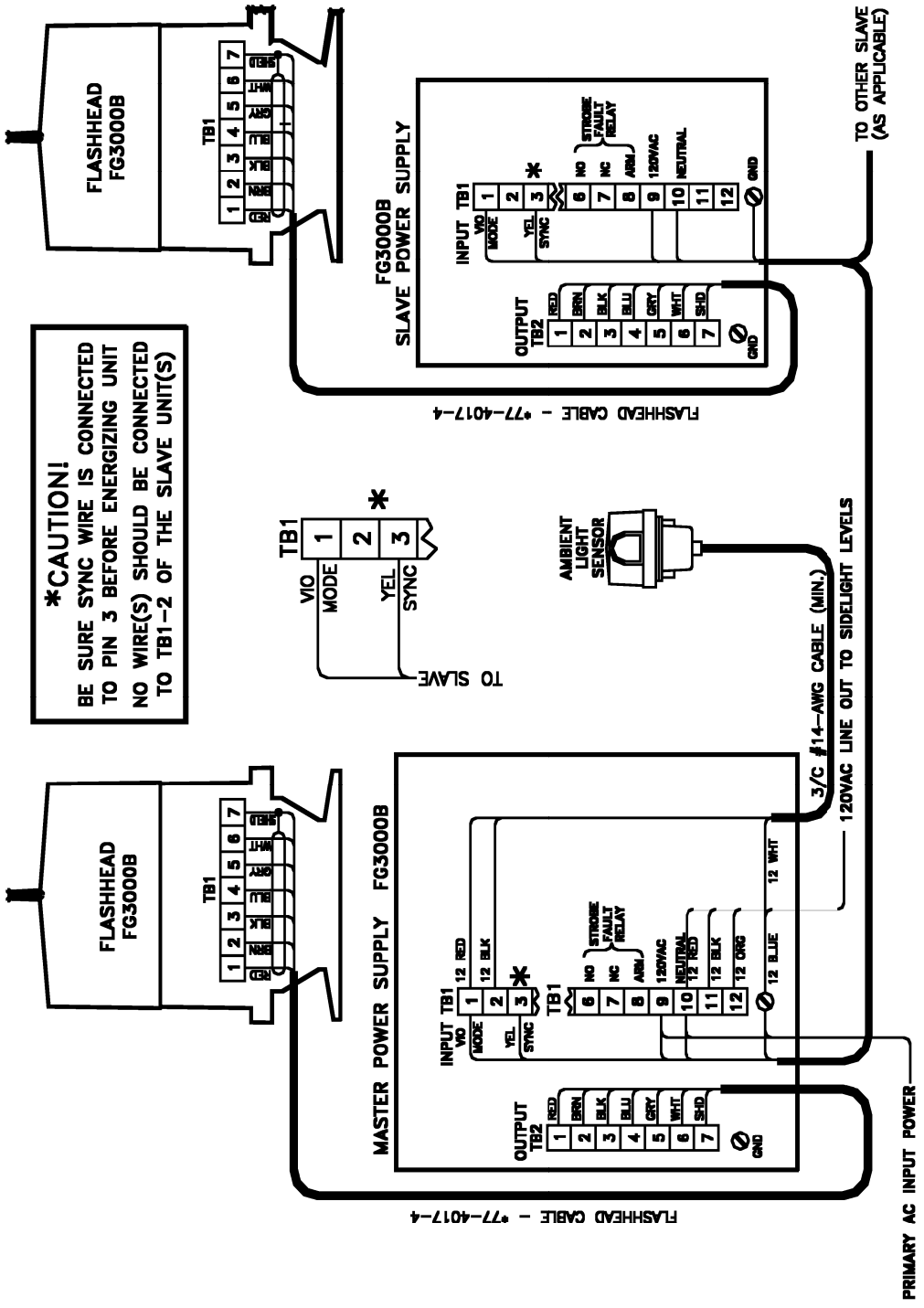

Figure 8. System Wiring Diagram for Master / Slave Units

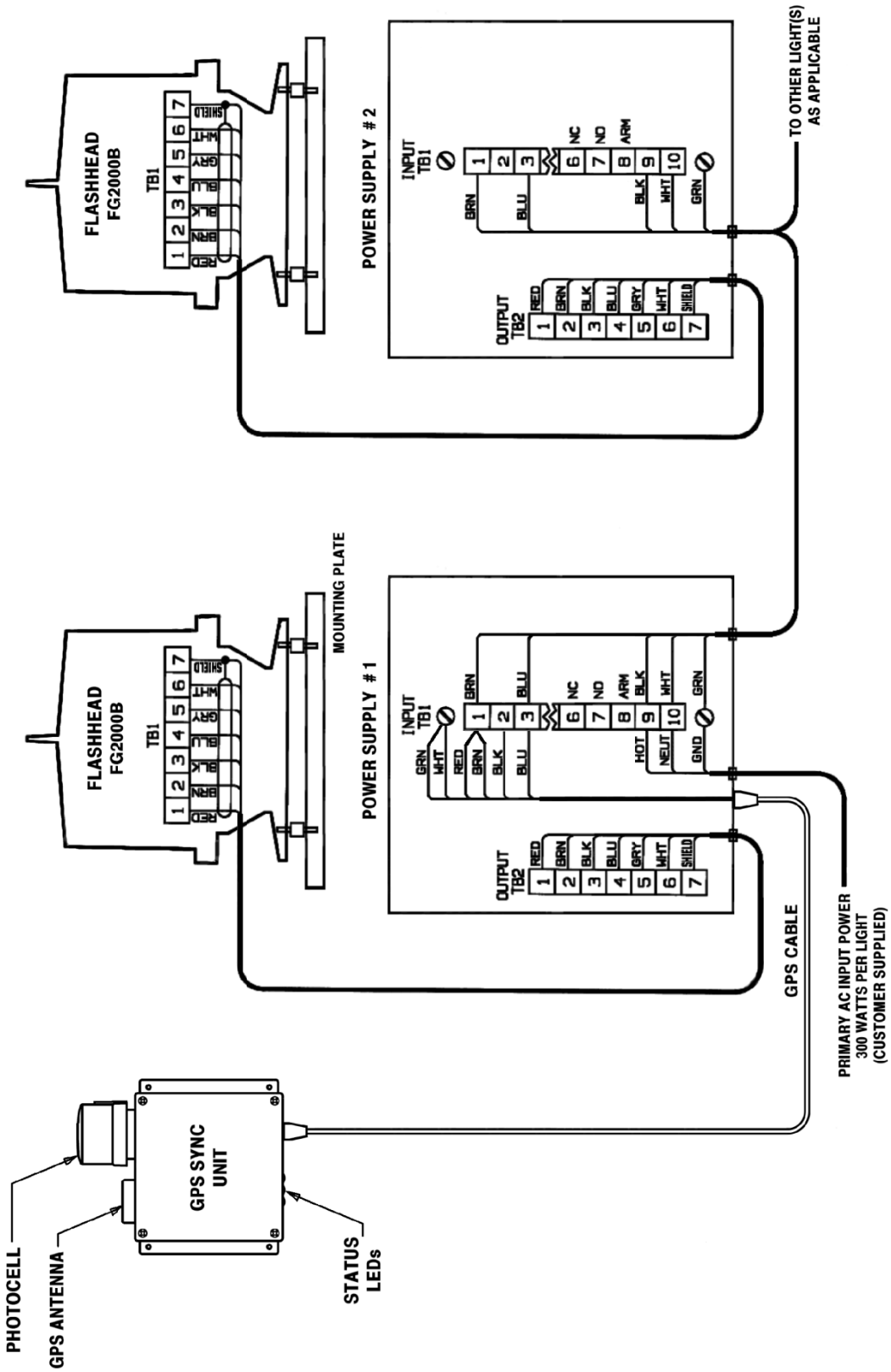

Figure 9. System Wiring Diagram for Units with GPS

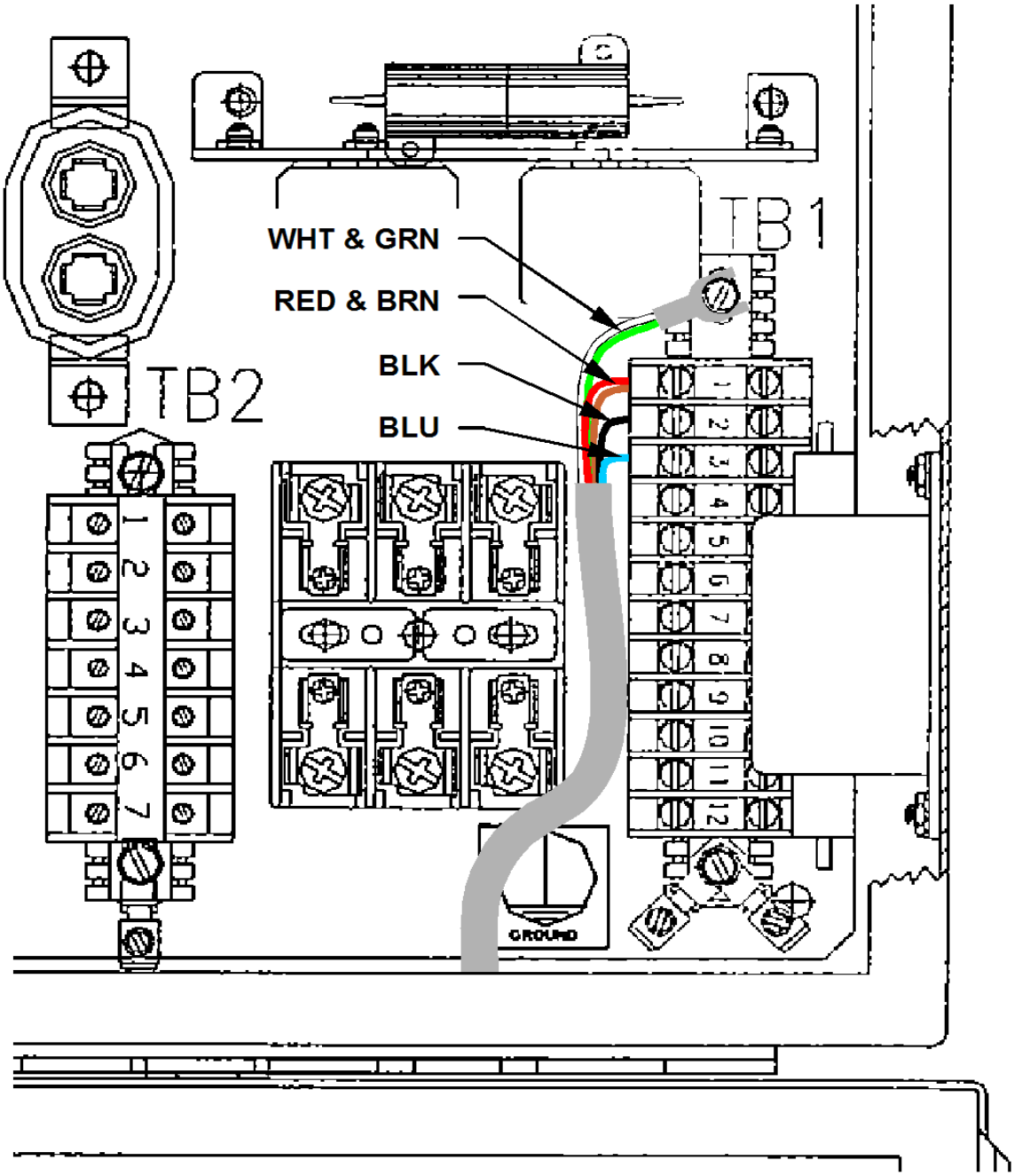

Figure 10. Internal Wiring Diagram for Unit with GPS

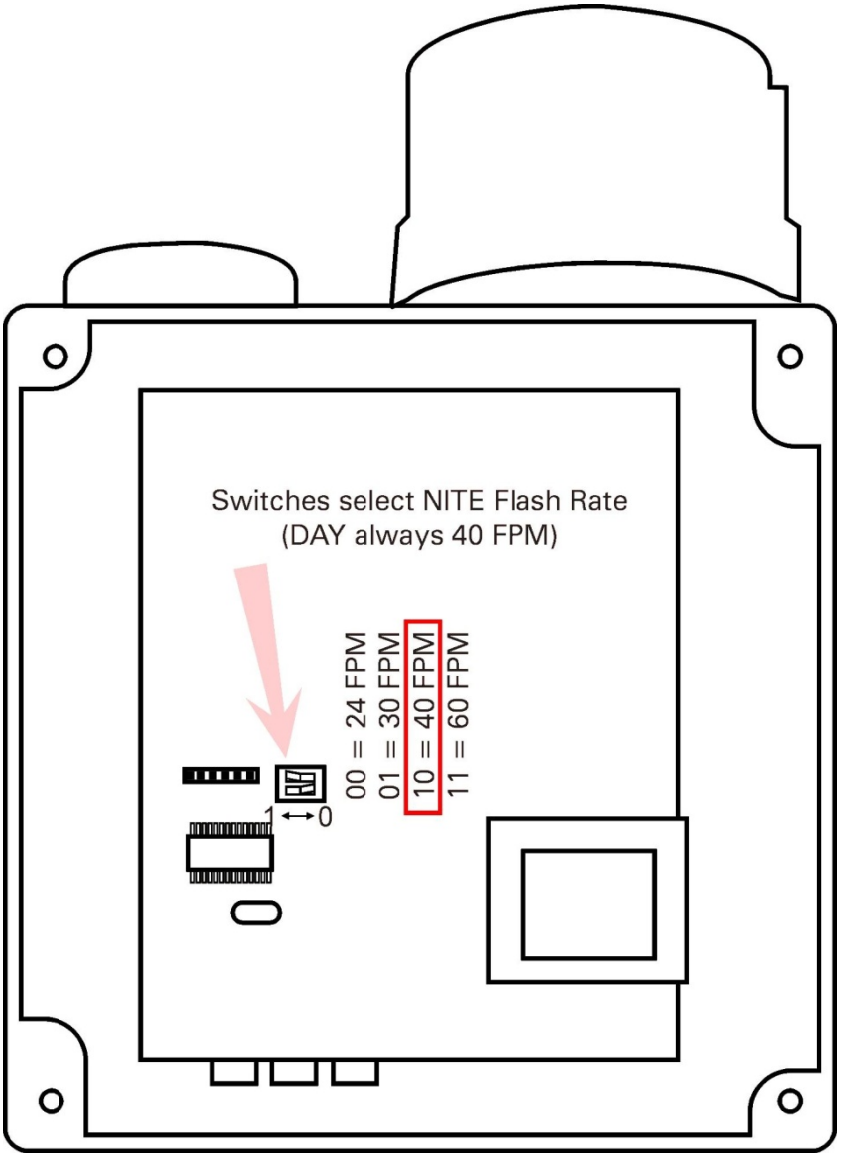

Figure 11. GPS Flash Rate Dip Switch Positions

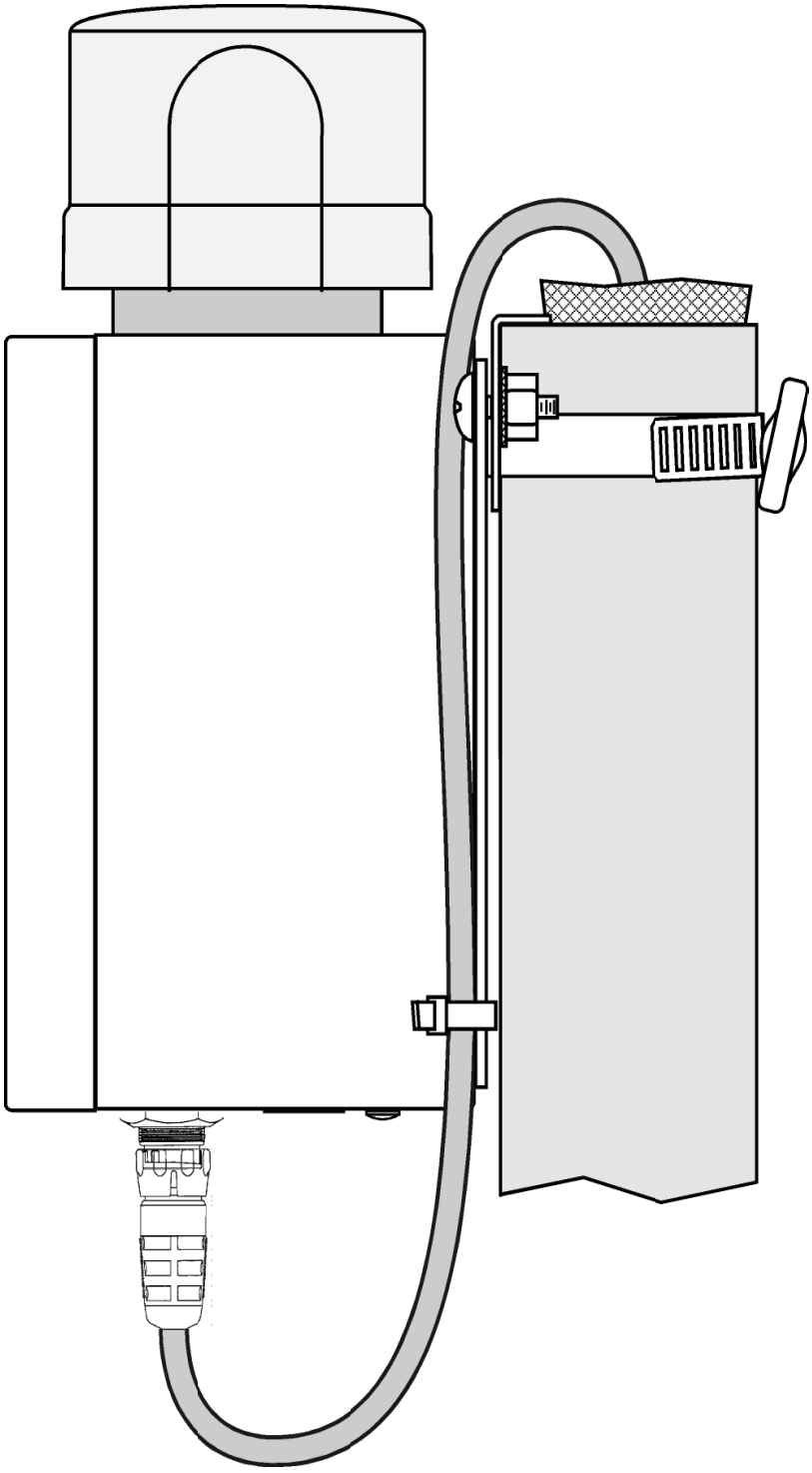

Figure 12. GPS Pole Mount (Optional)

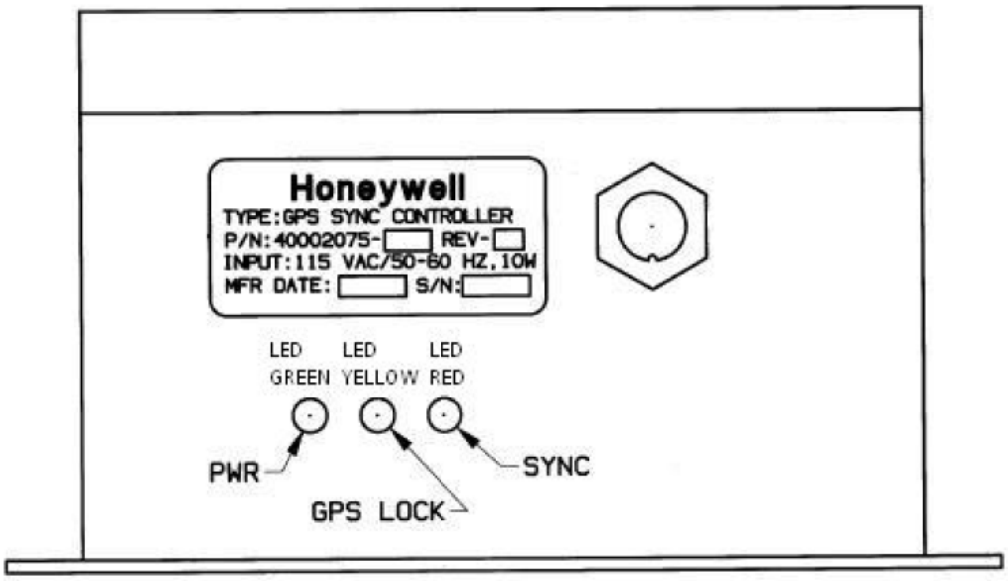

Figure 13. GPS Unit (Optional)

2.6 Final Check

Before applying power to the equipment, check all relays and printed circuit boards (PCBs) to ensure that they are properly seated in their sockets. Check to ensure that any user-installed wiring does not interfere with relay operation when covers are closed.

3.0 OPERATION

3.1 General

This section provides information for operating the lighting system during normal operating conditions.

3.2 Operating Procedures

After the system has been wired according to the instructions in Section 3, it is ready for normal operation. The flashhead assembly should be closed and secured. When the cover of the power supply is closed so that the interlock switch is engaged and power is applied, the system will begin to operate. If there is sufficient light and the ambient light sensor is mounted correctly, the system will automatically switch to the correct mode after a 1 to 2 minute delay. The delay protects against unwarranted switching due to momentary changes in the light reaching the sensor. If a GPS sync unit is used the GPS sync indicator should begin flashing at power-up, but allow 20 minutes for full sync operation. The built-in antenna requires clear view of the south horizon (in the northern hemisphere) up to 5 degrees elevation (position the antenna straight up).

3.3 Status Indicators

Refer to Table 4 LED status indicators.

Table 4. LED Status Indicators

Indicator	Description
Control power ON	Located on the control panel (top center), this indicator is illuminated whenever input power is present and the power supply interlock switch is engaged.
High Voltage Neon Lamp	Located on the high voltage circuit (top) board, this lamp indicates that the high voltage circuits are active. Extreme caution should be used if the neon lamp is on.
Flashhead Alarm Status LED	Located on the sync/monitor (middle) board, this LED will be green when the flashhead is operating correctly. If the LED is off, the system is in alarm mode.
Sync Out LED	Located on the sync/monitor (middle) board, this LED blinks red to indicate that a sync signal has been generated. In a multiple flashhead system, only the sync/monitor board that is set as the master will blink this LED
Sync In LED	Located on the trigger/control (bottom) board, this LED blinks green to indicate that a sync signal has been received from the sync/monitor board.
Flashtube Status LED	Located on the trigger/control (bottom) board, this LED is red if the red flashtubes are in operation. If the white flashtubes are being used, the LED is off.
Side light Failure LED(s)	Located on the alarm card (AC) inside the lid of power supply, these LEDs turn red to indicate a side light lamp failure. This LED is green when the sidelights are operating properly. LED2 will be lit RED during night operation when only one sidelight level is in use.
GPS SYNC Green LED	Located on the bottom of the GPS sync unit (Refer to Figure 13), this LED will turn green when power is on.
GPS SYNC Yellow LED	Located on the bottom of the GPS sync unit (Refer to Figure 13), this LED will turn yellow when unit has locked onto a satellite signal.
GPS SYNC Red LED	Located on the bottom of the GPS sync unit (Refer to Figure 13), This LED will flash red with each sync pulse.

4.0 FUNCTIONAL DESCRIPTION

4.1 General

The purpose of Section 5 is to provide a general overall description of how the equipment components function with relation to each other (equipment as a whole) and functional description of how individual units or subassemblies of the equipment function.

4.2 Major Assemblies

The AC main power input to the power supply is converted to approximately 1,000 VDC to bias the flashtubes in the flashhead and to charge the energy storage capacitors. The ambient light sensor sends correct control signals to the power supply to automatically change the intensity of the flashhead and control the red incandescent side lights.

The main power to the power supply is applied to the control and logic circuitry, thereby activating relays that determine the intensity of the flashhead. Logic circuits in the power supply generate a timing signal that controls the rate of flash. The GPS sync signal disables the internal clock circuit. The flash occurs at the same time as the sync signal.

Test switch located on the switch panel allows the system to operate in either day or night mode. This switch should be left in the AUTO position for photocell operation.

4.3 Functional Description of Subsystems

4.3.1 Lighting System Flashhead and Power Supply

The main AC input power is transformed to high voltage DC and stored in capacitors. The trigger circuit fires the flashtube, in parallel with the capacitors. This discharges the capacitors, producing a flash of light. Changing the capacity for energy stored between flashes varies the intensity of the light. The flashtube extinguishes when current from the capacitors is too low to support the arc. The power supply short circuit current is set below the minimum tube current to prevent continuous conduction. The capacitors then recharge for the next flash.

Input power is applied to the primary of the ferroresonant power transformer (T1) when the flashhead and cover interlocks are closed. The high voltage output of T1 is rectified and charges the energy storage capacitors.

In the day mode, normal operation has the interlock relay (K1) energized while the day/night relay K2 is de-energized. Capacitors C2 and C3 in the high voltage circuit are kept charged. With this amount of capacitance in the circuit and DC voltage provided, sufficient energy is discharged through flashtube to produce an effective intensity of 20,000 candelas (±25%).

In the night mode (low intensity), 120 VAC is supplied from the photocell and applied to the power supply (on TB1-1) and to the day/night relay (K2). When K2 is energized, its contacts will remove C2 from the high-energy circuit and discharge it through R2 and R4. Now only C3, with R3 in series,

is in the tube circuit. This provides the energy required to produce the effective intensity of approximately 2000 candelas. Concurrently, 120 VAC

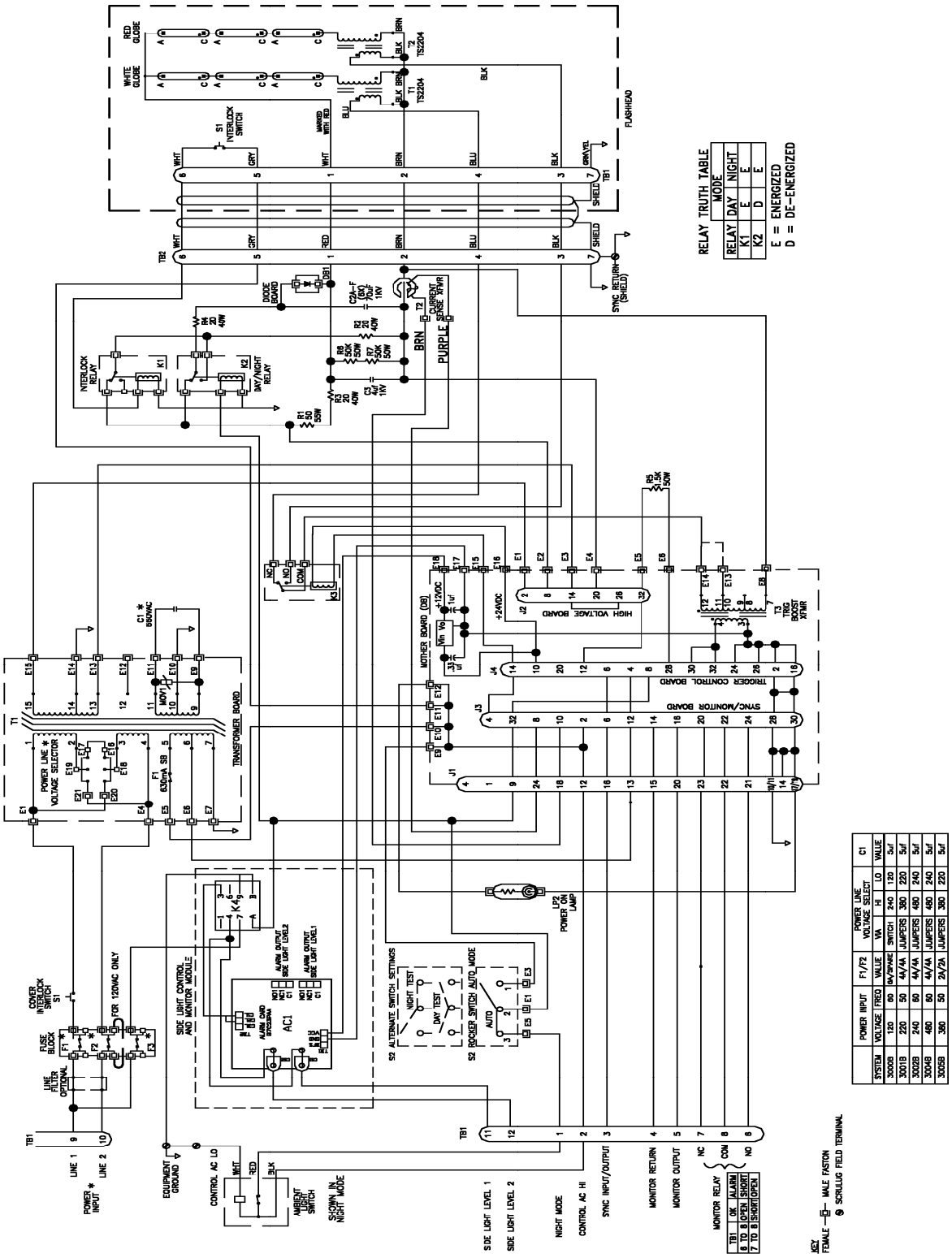

Figure 14. FG3000B Lighting System Schematic Diagram

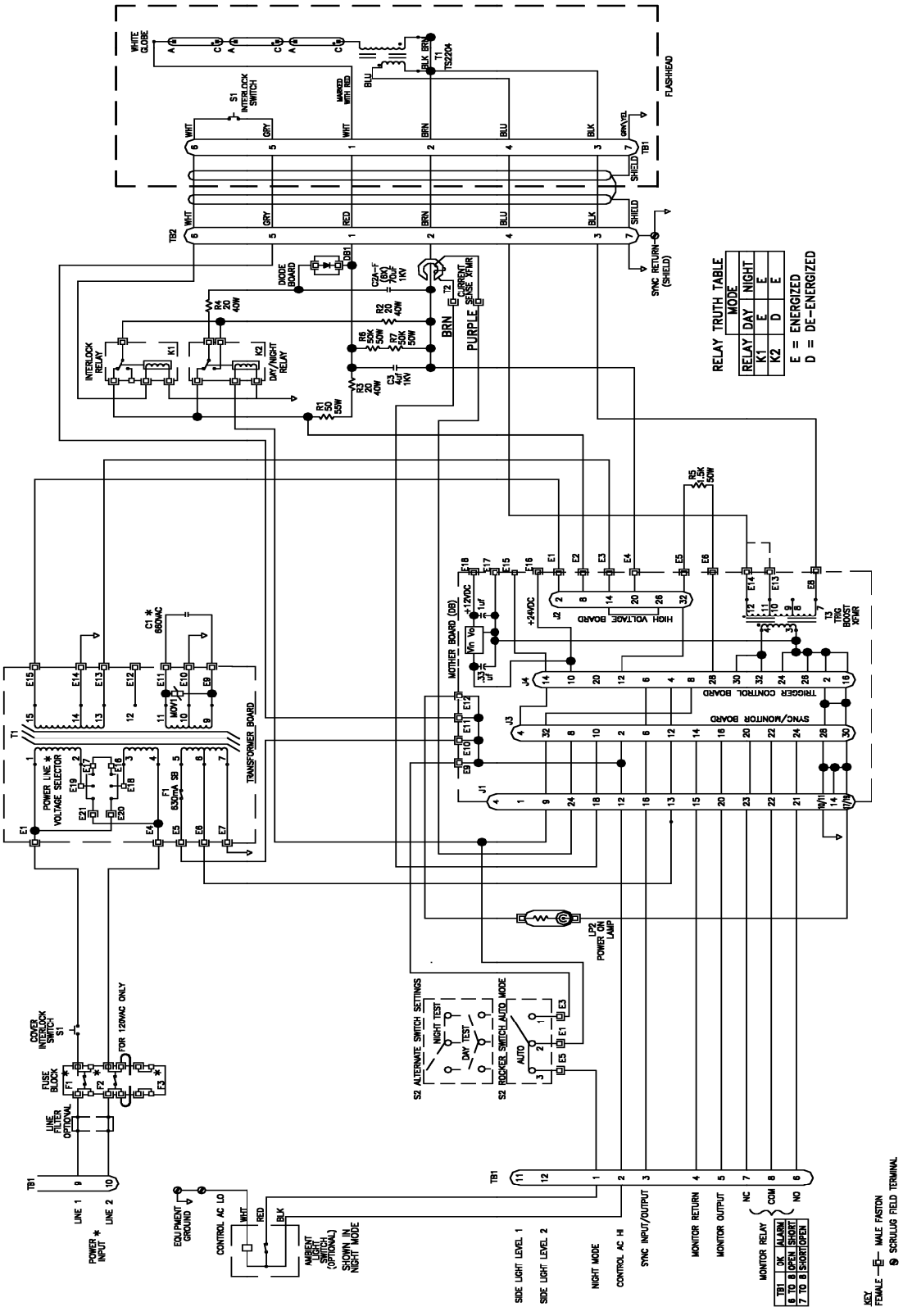

Figure 15. FG2000B Lighting System Schematic Diagram

is applied to pin 8 of the trigger control PCB, switching logic from single shot to burst mode. The AC voltage is also applied to pin 32 of the sync/monitor PCB, establishing the number of red FPM.

4.3.2 Side Lights

The AC night control voltage at TB1-1 operates a red light control module consisting of a SPDT relay and an alarm card. These components power and monitor any red obstruction lights used in conjunction with the lighting system, indicating the loss of any incandescent bulb or LED fixture. The module will control up to two levels of four 120 V steady burning sidelights.

4.3.3 High Voltage PCB

The high voltage PCB consists of a three-diode-per-leg bridge and two 3-diode circuits. High voltage AC from the power transformer is provided to the HV PCB connector. This high AC voltage is full wave bridge rectified by the bridge. Neon lamp, LP1, lights whenever high voltage is present.

4.3.4 Trigger Control PCB

The function of the Trigger Control PCB is to provide a synchronized trigger pulse to the primary of a trigger transformer located in the flashhead. A single pulse in the day mode and a burst in the night mode. DIP switches set the burst flashes individually for red, SW1, and white operation, SW2.

SW1	OFF	ON		SW2	OFF	ON
1	0	1		**1**	0	1
2	0	2		**2**	0	2
3	0	4		**3**	0	4
4	0	8		**4**	0	8
5	0	16		**5**	Disable Day Mode	Enable Day Mode
6	0	32		**6**	Not Used	

- settings per shaded areas

Figure 16. FG3000B Trigger Control Switch Settings

SW1	OFF	ON		SW2	OFF	ON
1	0	1		**1**	0	1
2	0	2		**2**	0	2
3	0	4		**3**	0	4
4	0	8		**4**	0	8
5	0	16		**5**	Disable Day Mode	Enable Day Mode
6	0	32		**6**	Not Used	

- settings per shaded areas

Figure 17. FG2000B Trigger Control Switch Settings

SW1	OFF	ON		SW2	OFF	ON
1	0	1		**1**	0	1
2	0	2		**2**	0	2
3	0	4		**3**	0	4
4	0	8		**4**	0	8
5	0	16		**5**	Disable Day Mode	Enable Day Mode
6	0	32		**6**	Not Used	

- settings per shaded areas

Figure 18. FG2009B Trigger Control Switch Settings

4.3.5 Sync/Monitor PCB

The function of the Sync/Monitor Board is to generate a sync pulse for the trigger control board; to select AC 50 or 60 Hz or DC input power, master or slave operation; and to detect faulty operation of the lighting system such as missing or out of sync flashes.

The Day Mode flash rate is set at 40 FPM per FAA requirements and cannot be changed.

The Nite Mode flash rate can be adjusted between 20–40 FPM per FAA requirements. Switch S2 allows for field adjustment of the nite flash rate. See Figure 19 for switch settings.

Field adjustment can also be made at Switch S1 for the following:

- AC or DC voltage
- 50 Hz or 60 Hz
- Night Light (White or Red)
- Master or Slave

The flashes per minute (FPM) for the red night system can be field adjusted by setting S2 to equal the number in the FPM table:

Power Line Freq. Hz	**Flashes Per Minute FPM**		
	20	**30**	**40**
DC	125	100	75
50	125	100	75
60	150	120	90

Figure 19. Sync/Monitor Switch Settings

The switch settings shown in Figures 20, 21, and 22 represent the units with the following characteristics

Input Phase – AC
Input Frequency – 60 Hz
Stand-alone (i.e. Master)

Same units may have different settings. If the your model does not match the units shown here, please contact Honeywell Technical Support at 805-581-5591 for specific switch settings.

S1	OFF	ON
1	AC	DC
2	50 Hz	60 Hz
3	White Light @ Night	Red Light @ Night
4	Master Sync Card	Slave Sync Card

S2	OFF	ON
1	0	1
2	0	2
3	0	4
4	0	8
5	0	16
6	0	32
7	0	64
8	0	128

- settings per shaded areas

Figure 20. FG3000B Sync/Monitor Switch Settings

S1	OFF	ON
1	AC	DC
2	50 Hz	60 Hz
3	White Light @ Night	Red Light @ Night
4	Master Sync Card	Slave Sync Card

S2	OFF	ON
1	0	1
2	0	2
3	0	4
4	0	8
5	0	16
6	0	32
7	0	64
8	0	128

- settings per shaded areas

Figure 21. FG2000B Sync/Monitor Switch Settings

S1	OFF	ON
1	AC	DC
2	50 Hz	60 Hz
3	White Light @ Night	Red Light @ Night
4	Master Sync Card	Slave Sync Card

S2	OFF	ON
1	0	1
2	0	2
3	0	4
4	0	8
5	0	16
6	0	32
7	0	64
8	0	128

- settings per shaded areas

Figure 22. FG2009B Sync/Monitor Switch Settings

4.4 GPS SYNC

The function of the GPS sync is to generate a sync pulse for the trigger control board.

The Day Mode flash rate is set at 40 FPM per FAA requirements and cannot be changed.

The Nite Mode flash rate can be set for 24, 30, 40 or 60 FPM. Switch S1 on the GPS unit allows for field adjustment of the night flash rate. See Figure 11 for switch positions and Figure 23 for the flash rate settings.

GPS UNIT S1		
0 = Open	**1 = Closed**	**FPM**
0	0	24
0	1	30
1	0	40
1	1	60

Figure 23. GPS Sync Switch Settings

- Switch S1-4 on the Sync/Monitor Board should be in the ON (slave) position for all GPS-controlled units.

4.5 System Failure (Alarms)

4.5.1 Strobe Failure

Fail detection during the day operation causes fault relay K1 on the Sync/Monitor board to open 10 seconds after the last normal flash. Occasional missed flashes will go undetected. The fault relay closes whenever normal operation is restored (a go condition).

Fail detection during night operation in addition to opening the fault relay (fail condition), establishes operating conditions for white/night flashtube operation. White/night operation only occurs whenever red operation fails, and begins 10 seconds after the last flash of the red lamp. The preset white/night flashing conditions are: 40 FPM giving an equivalent light output of 2,000 candelas. Operation in this mode continues until day mode is called for, or power is interrupted. When day operation is called for by the photocell, the fail detection system verifies proper day operation, closing the fail relay K1.

A test button switch is located on the top edge of the PCB. This switch grounds out the flash signal when held closed, thus simulating flash failure. To operate, hold the test button closed for longer than 10 seconds.

Single-pole double-throw relay contacts are available (12E00045-002) for monitoring. Continuity between TB1-7 and TB1-8 is maintained closed while TB1-6 and 8 is open as a go condition. Continuity between TB1-6 and 8 represents a fault condition, while TB1-7 and 8 is open.

4.5.2 Alarm Card (AC)

The side light alarm provides fault indicators when one or more incandescent lamps or LED fixtures fail. When a lamp fails, a decrease in current is sensed and the alarm card transfers to the alarm mode. This is reflected in two ways. The red LED lights and the relay transfers to provide an open circuit between the common (wiper) and the normally closed contacts and a closed circuit between the wiper and the normally open contact. Replacement of a failed lamp resets the alarm output and extinguishes the LED. During the day mode when the red lights are not on, the module does not report an alarm.

		STATUS	
MODE		**OK**	**ALARM**
DAY	RELAY1	C1-NC1	C1-NO1
	LED1	GREEN	RED
	RELAY2	C1-NC1	C1-NO1
	LED2	GREEN	RED
NIGHT	RELAY1	C1-NC1	C1-NO1
	LED1	GREEN	RED
	RELAY2	C1-NC1	C1-NO1
	LED2	GREEN *(RED IF UNUSED)*	RED

Table 5. Side Light Alarm Module Fault Indicators

5.0 TROUBLESHOOTING AND CORRECTIVE MAINTENANCE

5.1 General

The purpose of Section 6 is to provide procedures that enable the troubleshooter to isolate and correct the causes of malfunctions. Such corrective action may be in the form of an immediate fix of a problem or may direct the troubleshooter to a corrective maintenance procedure for adjustment or repair.

5.2 Tools Required

- Flat head screwdriver
- 5/16 nut driver to open flashhead
- Clean gloves to use when changing flashtubes
- Digital multimeter w/ Ohm reading and 500 VDC capacity
- NE2 neon light, HONEYWELL part number *77-2342
- Short piece of wire for jumper (Approx. #12 wire gauge)

5.3 Troubleshooting Procedures and Tables

Logic diagrams direct maintenance personnel to associated tables listing the malfunction, test, and corrective maintenance action to perform.

5.4 Flashhead (Strobe) Problems Logic Diagram

Utilize the following logic diagram to determine the most correct course of maintenance action to perform to troubleshoot the flashhead when strobe problems occur. Utilize Table 6 in conjunction with the logic diagram.

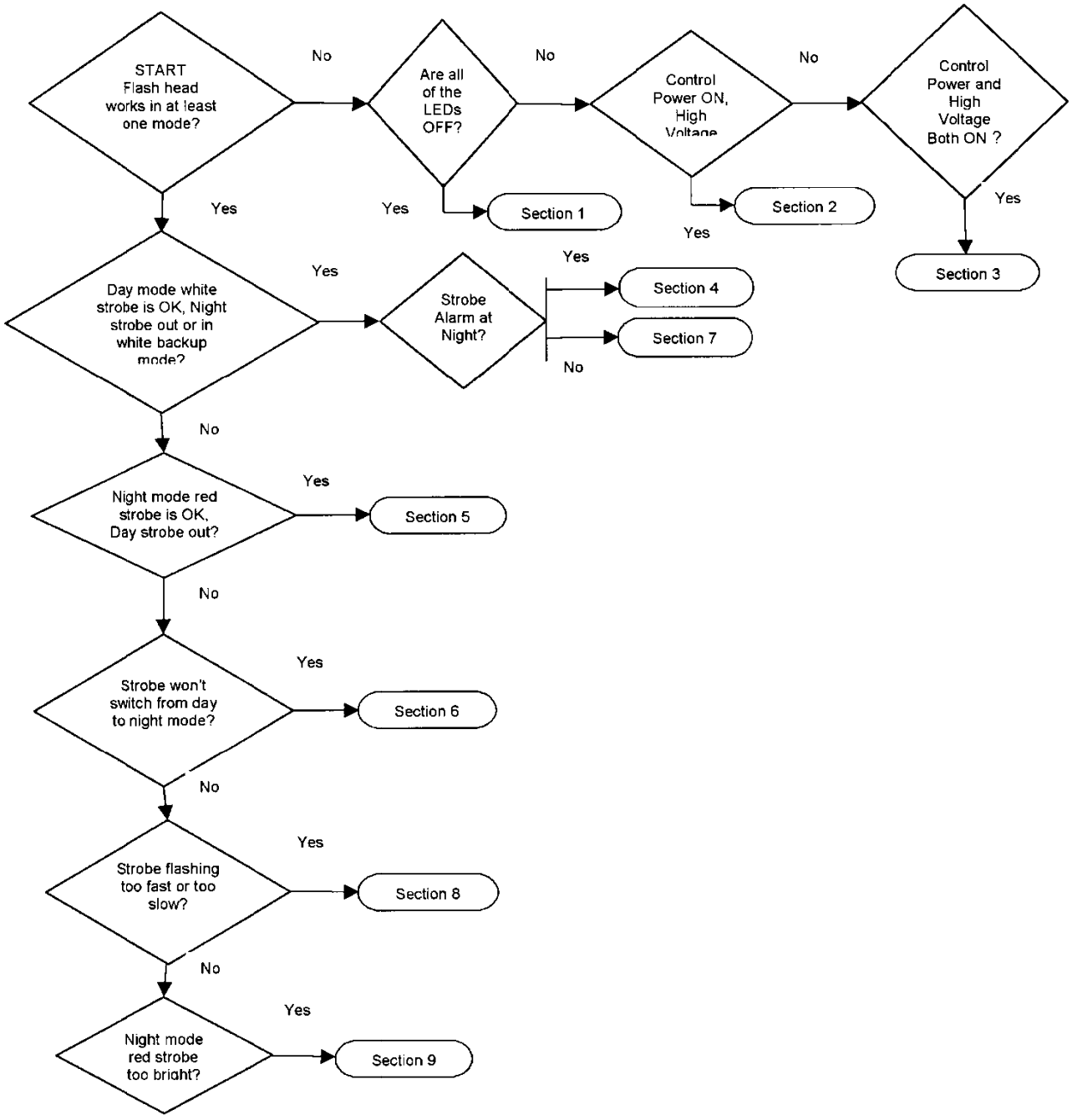

Table 6. Flashhead (Strobe) Problems Corrective Maintenance

Malfunction	Test	Corrective Action
Section 1 Flashhead does not operate in any mode, no LEDs on.		
Input power incorrect.	Measure input power – it should be with ±10% of required voltage.	Supply correct input power.
Power supply interlock switch not engaged.	Press the power supply interlock switch and hold it down.	Close the unit – the system should operate properly.
Blown F1 (6 Amp) fuse, or transformer (630mA) fuse.	Remove all three PCBs and check for damage. Remove the photocell wiring from TB1-1 and TB1-2. Perform flashhead isolation test and check for improper resistances. Leave the flashhead cable disconnected, replace the fuse and apply power. Replace the strobe cable, the photocell wiring, and the PCBs one by one to determine which one will blow the fuse.	Replace the defective component.
Section 2 Flashhead does not operate in any mode, control power indicator on, high-voltage neon lamp off.		
Flashhead interlock switch not engaged.	Remove the flashhead wires TB2-5 and TB2-6 (gray and white), and measure resistance between them - it should be less than 5Ω.	Re-seat the flashhead cover, making sure the interlock switch engages when the cover is closed. If the system still does not have continuity between TB2-5 and TB2-6, replace the flashhead interlock switch and inspect the strobe cable for damage.
Relay **K1** not energizing.	When the interlock switches are engaged, the K1 relay should energize. If not, measure for 120 VAC across the relay coil. Alternatively, remove the connectors and check resistance across the K1 coil – it should be 300Ω.	Replace the K1 relay.

Faulty high-voltage PCB.	Visually check the traces on the high-voltage PCB. Check for any shorted diodes. Use diode check function on multimeter if available.	Replace the high-voltage PCB.
Section 3 Flashhead does not operate in any mode, control power indicator on, high-voltage neon lamp on.		
Trigger control PCB defective or incorrect DIP switch setting.	Perform flashhead isolation test and power supply isolation test. Compare trigger PCB DIP switch settings with default settings in technical manual.	Set DIP switches according to specifications. If no trigger is observed when performing Trigger Test, replace the trigger control PCB.
Insufficient trigger voltage to the flashhead.	If tower height is greater than 340 feet, remove the connector at terminal E13 on the motherboard, and connect it to E14. This will boost the voltage to the flashhead by approximately 10%.	Leave the connector at E14.
Section 4 Flashhead operates properly in day mode, but at night goes into white backup night mode and trips the strobe alarm.		
Red flashtube/ red trigger transformer faulty.	Swap the wires between TB2-3 and TB2-4. Put the unit in night mode. After this test return the wires to their original positions.	If system flashes red night mode through the white flashtube, with the strobe alarm off, replace the red flashtube and/or red trigger transformer. Green LED on Sync Board = ON
Trigger control PCB faulty.	Perform power supply isolation test to check for trigger pulses.	Replace the trigger control PCB.
Diode PCB **DB1** faulty.	Remove the two mounting screws on the control panel. Disconnect DB1, and measure resistance both ways across each diode. Make sure no diodes have shorts. If shorted, DB1 is faulty. **Note:** The diode PCB DB1 is located under the control panel where the test switches are.	Replace DB1.
Section 5 Flashhead operates properly in night mode, strobe alarm is off. No flash in day mode, strobe alarm is on.		

Day Enable switch SW2-5 on the trigger control PCB set to OFF.	Set SW2-5 on the trigger control PCB to ON, then test the unit in day mode.	Leave SW2-5 ON.
White flashtube and/or white trigger transformer faulty.	Swap the wires on TB2-3 and TB2-4 Put the unit in day mode. After performing this test return the wires to their original position.	If system flashes day mode through the red flashtube, with the strobe alarm off, replace the white flashtube and / or white trigger transformer. Green LED on Sync Board = ON.
Trigger control PCB faulty.	Perform power supply isolation test to check for trigger pulses.	Replace the trigger control PCB if test fails.
Diode PCB DB1 faulty.	Remove the two mounting screws on the control panel. Disconnect DB1, and measure resistance across each diode. Replace DB1 if any diodes have shorted. Note**:** The diode PCB DB1 is located under the control panel where the test switches are.	Replace DB1.
Section 6 System will not switch between day and night modes correctly.		
Mode switches in wrong position.	Put rocker switch (S2) in Auto position. Illuminate the photocell for a minute or so to approximate daytime conditions. The system should go into day mode. Cover the photocell with a thick, dark, opaque material, to approximate nighttime conditions. Wait for a minute or so. The system should go into night mode. If the system does not respond correctly to the photocell, try changing modes by using the rocker switch on the control panel.	If the system responds to the switch changes, but not to the photocell, replace the photocell.

K2 mode relay malfunctioning.	Set the day mode switch to Remote, night mode to Test. The K2 relay should energize. If not, measure for 120 VAC across the relay coil. Alternatively, remove the connectors and check resistance across the K2 coil – it should be at 300Ω.	Replace the K2 relay.
Section 7 System operates properly in day mode, but at night goes into white backup night mode, no strobe alarm.		
Sync PCB switch S1-3 set to white night mode – OFF position.	Set S1-3 to red night mode – ON position.	
Section 8. Flashhead flashing slow (<20 FPM), in backup mode at night, and strobe alarm on.		
Not configured or defective sync monitor PCB.	Ensure the DIP switches on the sync monitor PCB are set correctly per the manual. Visually verify that the red LED on the sync monitor PCB is pulsing at 40 FPM.	If the DIP switch settings are correct, and the red LED is not pulsing at 40 FPM, replace the sync monitor PCB.
Current sense transformer wires are crossed, or current sense transformer is defective.	The brown wire should connect to the capacitor side of the current sense transformer, the purple wire towards TB2.	If the transformer wires are correct, replace the current sense transformer.
Defective GPS Sync unit	Swap with a known good unit	Replace the GPS sync unit.
Section 9 Night mode very bright, red, no alarms.		
Relay K2 open.	Put the system in night mode. Check for 120 VAC across the coil of the K2 relay. Alternatively, remove the connectors and check resistance across the K2 coil – it should be @ 300Ω.	Replace the K2 relay.

5.5 Multiple Strobe Problems Logic Diagram

Utilize the following logic diagram to determine the most correct course of maintenance action to perform and to troubleshoot the flashhead when multiple strobe problems occur. Utilize Table 7 and the section listed in the logic diagram.

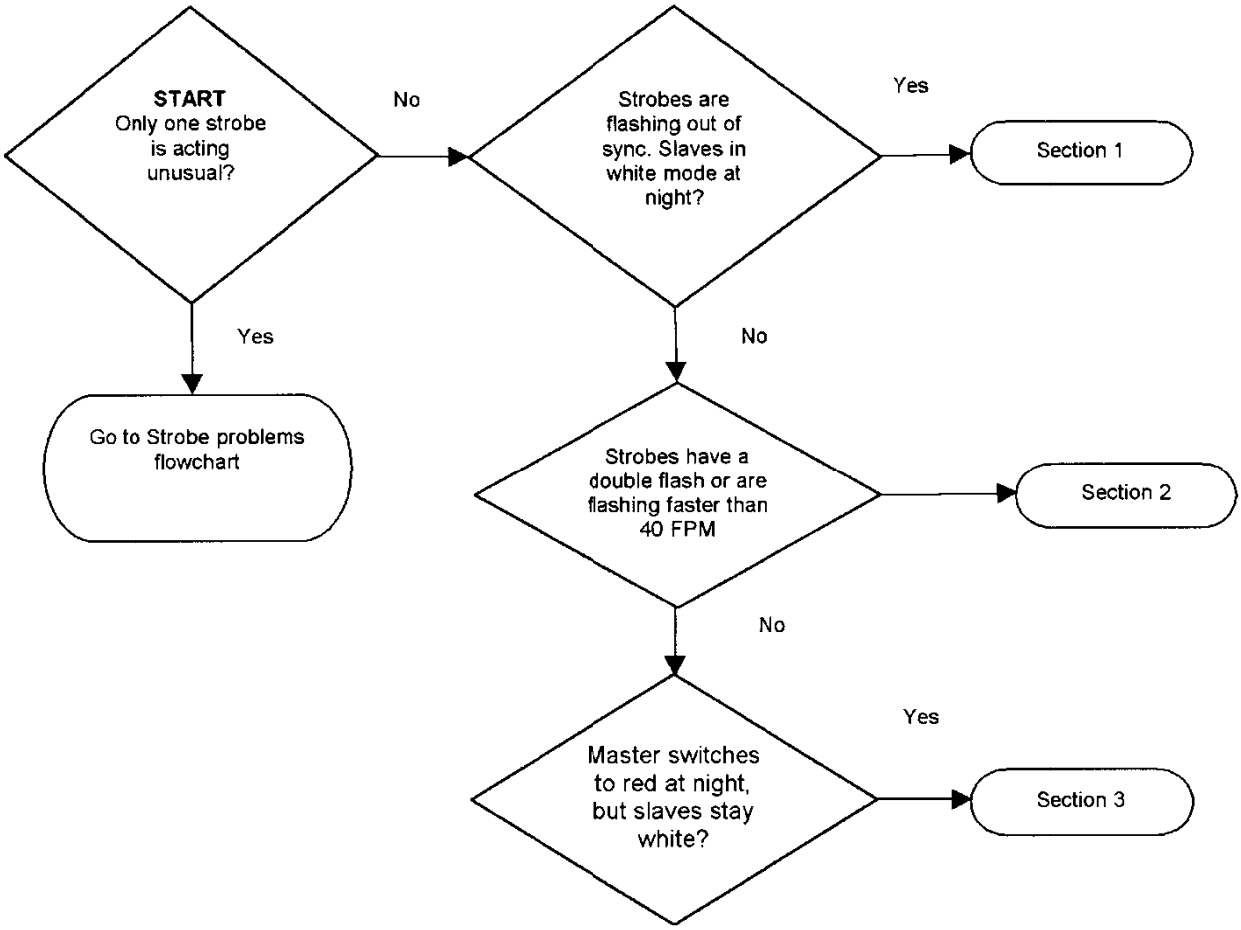

Table 7. Multiple Strobe Problems Corrective Maintenance

Malfunction	Test	Corrective Action
Section 1 Flashheads are operating, but out of sync. At night, slave units in white backup night mode instead of normal red.		
Sync monitor PCB on the master power supply not configured as master.	DIP switch S1-4 in the master unit should be set to OFF.	
Interconnecting wire between master and slave power supplies missing.	Inspect wiring between power supplies. TB1 position 3 should be daisy-chained between each power supply, per the installation wiring diagram.	Install interconnecting wiring.
Sync/Monitor S1-4 is OFF, GPS Sync Unit Defective or Incorrectly wired.	Check S1-4 position. Inspect wiring. Swap the GPS Sync Unit with known good unit.	Turn ON S1-4. Correct wiring. Replace the GPS Sync Unit.
Section 2 All lights are in sync, but there is a double-flash, or flashing faster than 40 FPM.		
More than one sync monitor PCB is set as master.	Inspect the DIP switches on each sync monitor PCB. In the master power supply, DIP switch S1-4 should be set to OFF, which is the master position. In all the other power supplies, this switch 4 should be set to ON, which is the slave position	Reconfigure sync monitor PCBs. Refer to the manual for correct positions.
Section 3 Master unit switches to night mode at night, but slave units remain in day mode.		
Interconnecting wire between master and slave power supplies missing.	Inspect wiring between power supplies. TB1 position 1 should be daisy-chained between each power supply, per the installation wiring diagram for multiple units.	Install interconnecting wiring.

5.6 Side Light Problems Logic Diagram

Utilize the following logic diagram to determine the most correct course of maintenance action to perform and to troubleshoot the flashhead when side light problems occur. Utilize Table 8 and the section listed in the logic diagram.

Table 8. Side Light Problems Corrective Maintenance

Malfunction	Test	Corrective Action
Section 1 Side lights not operating at night.		
Verify correct wiring per installation diagram. On systems with more than one power supply, note that each side light module should run two levels of side lights		
F3 fuse open.	Remove the F3 fuse. Check for continuity.	Reseat / Replace.
Power supply rocker switch is in the wrong position.	Make sure rocker switch is in the Auto position, and that the photocell is not illuminated (if necessary, temporarily cover it to simulate nighttime).	
Section 2 Side lights in alarm		
Side light lamp burned out.	On the alarm card (AC1) set the DIP switches to monitor 1 (one) less side light than the current number (reference switch setting positions in manual). Alternatively, measure the current going out to your side lights though the wire on TB1-11 or TB1-12. Compare your current reading to the nominal (expected) current level to see how many side lights you have operating.	Replace burned out side light.
Wrong DIP switch setting on the side light alarm module.	Match DIP switch setting on AC1 at switch(es) SW1 or SW2 with the actual number of side lights to monitor.	
Low input voltage.	Check input voltage – it should with ±10% of required voltage.	Increase input voltage.

5.7 Flashhead Isolation Test

Turn off the input voltage at the circuit breaker to the power supply. Disconnect the seven conductor cable from power supply at terminal block TB2. Using an Ohmmeter, check the resistance between the conductors of the disconnected flashhead cable, and compare to the expected values:

5.7.1 FG200B Single Flashhead Readings (cable disconnected from power supply)

- #1 Red: Open to all conductors
- #2 Brown: Open to all conductors
- #3 Black: < 5Ω to blue, open to all others
- #4 Blue: < 5Ω to black, open to all others
- #5 White: < 5Ω to gray, open to all others
- #6 Gray: < 5Ω to white, open to all others
- #7 ground: Open to all conductors

5.7.2 FG3000B Dual Flashhead Readings (cable disconnected from power supply)

- #1 Red: Open to all conductors
- #2 Brown: < 5Ω to blue & black, open to all others
- #3 Black: < 5Ω to brown & blue, open to all others
- #4 Blue: < 5Ω to brown & black, open to all others
- #5 White: < 5Ω to gray, open to all others
- #6 Gray: < 5Ω to white, open to all others
- #7 ground: Open to all conductors

Flashhead Test Results

a) Correct readings do not ensure that the flashhead and cable are good, but this is a quick check for obvious problems.

b) If the readings above are correct, proceed to the Power Supply Isolation Test.

c) If the resistance between #5 (gray) and #6 (white) is greater than 5Ω, or is open, suspect that the flashhead interlock switch is not depressed.

d) For other inconsistencies with the above chart, the probable causes are incorrect wiring, or conductors shorted and/or opened. If possible, disconnect the flashhead cable at both ends and perform a Megger test with a Megohm Meter.

5.8 Power Supply Isolation Test

Leave the seven conductor strobe cable disconnected from the power supply at terminal block TB2. Install a jumper wire between terminals 5 and 6 to simulate the interlock switch being depressed. Install a neon lamp (HONEYWELL Part # 77-2342) across the trigger output. For the Day Mode, install the neon lamp in terminals 2 and 4 on TB2. For the Night Mode, install the neon lamp in terminals 2 and 3 on TB2. Apply power to the system and insure the following:

5.8.1 Voltage Measurements

Using a voltmeter, measure the voltages of the conductors to ground terminal 7. Check the measurements in both day and night modes, and compare to the expected values:

Power Supply Measurements

#1, Red: +500 VDC to ground	#4, Blue: –500 VDC to ground
#2, Brown: –500 VDC to ground	#5, Gray: 120 VAC to ground
#3 See Below	#6, White: 120 VAC to ground

If either the red or the brown conductor does not have +500 VDC or –500 VDC respectively, there is most likely a problem in the T1 transformer, the high voltage board, or a capacitor has failed. Check the input and output voltage of the transformer. Check the high voltage board for bad diodes. Check each capacitor for the proper value. If your meter will not measure capacitance (Farads) then check the capacitors for opens or shorts.

5.8.2 Neon Lamp Flash Rate

With the power supply in day mode, you should see one quick flash at a flash rate of 40 FPM. When the system is put into night mode, you should see a long burst of flashes for a few seconds. Then the lamp should begin flashing short bursts of flashes. This happens because the power supply can tell that the red flashtubes are not operating, so it tries to go into backup white night mode.

If the neon tube will never flash, you most likely have a problem with the trigger board. Check the DIP switch settings with those in the manual, and replace the board if necessary.

If the neon tube flashes slowly, you most likely have a problem with the sync board. Check the DIP switch settings with those in the manual, and replace the board if necessary.

If the neon lamp is flashing correctly, and the voltages are correct, the power supply is probably working, and the problem is likely in the flashhead or the strobe cable.

Remove neon lamp & jumper from TB2 before reconnecting the flashhead.

5.9 Flashhead Maintenance

No special or preventive maintenance is required for the flashhead, but only that which can be performed on an as-needed basis. Should it become necessary to replace the flashtubes, the following instructions must be adhered to:

WARNING

Ensure that the power is OFF and the capacitor bank has been discharged before opening the flashhead.

a) Loosen the eight (8) bolts securing the globe only enough to turn the black retainers. The bolts will fall out if they are loosened excessively.

b) After turning the black retainer's 90 degrees, lift the globe approximately twelve inches. When the top extent is reached, rotate the globe slightly (counterclockwise) to move the lift guide into its support position.

c) The two strings of three flashtubes are attached at both ends to sockets with connectors. See Figure 24. Disconnect both ends of the flashtube assembly to be replaced.

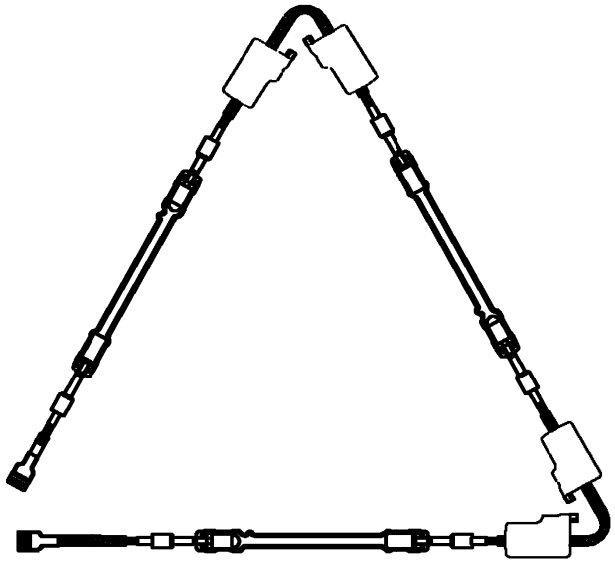

Figure 24. Flashtube Assembly with Ferrite Beads

d) Gently remove each flashtube from its supports, being careful not to break it. See Figure 25. Disconnect ferrite suppressors from quick-on fasteners.

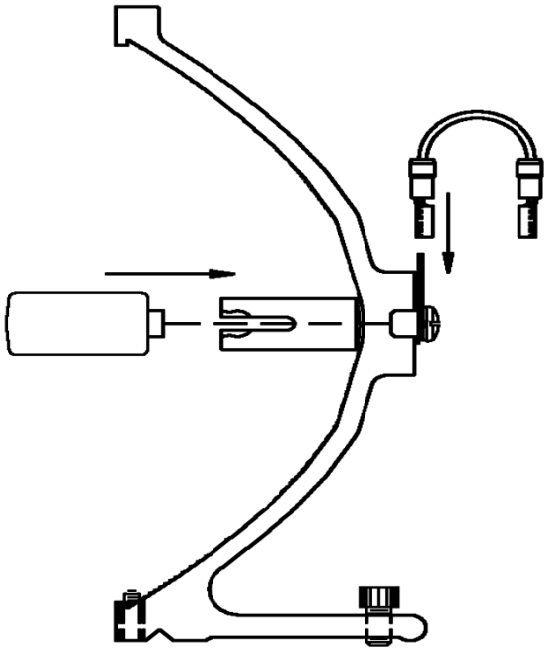

Figure 25. Attachment of Ferrite Beads with Quick-On Fasteners

CAUTION

Use a clean pair of gloves to handle the flashtubes. Fingerprints or contamination on the glass will adversely affect reliability of flashtubes.

e) Remove the new flashtubes from their container and connect the red-marked lead to the red socket. See Figure 26. Carefully connect ferrite suppressors to their quick-on fastener grounding lugs.

f) Working counterclockwise from the red socket, insert each flashtube into its pair of supports. Apply equal pressure TO THE METAL END CAPS ONLY (as shown in the illustration below) so that the ends of each flashtube are simultaneously snapped into place. THE FLASHTUBE ASSEMBLY IS EXTREMELY FRAGILE, especially at the junction between glass and metal. Handle the flashtubes in a manner that avoids stressing this critical seal.

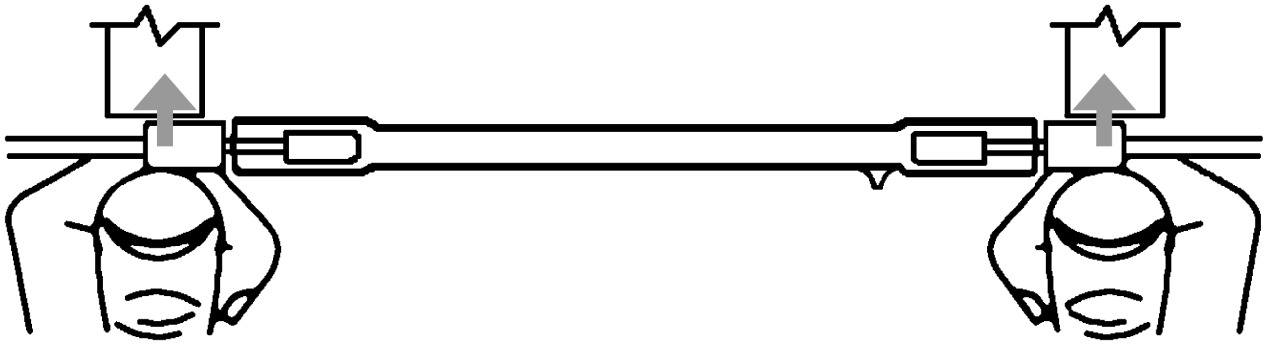

Figure 26. Flashtube Insertion

g) Connect the black-marked lead to the black socket.

h) Rotate the globe slightly (clockwise) to realign the lift guide in its vertical travel slot. Push down on the globe to re-seat it on the gasket.

i) Turn each black retainer back 90 degrees and tighten the bolts.

5.10 Power Supply and Light Sensor Maintenance

The power supply and ambient light sensor require no special maintenance. The light sensor should be checked and cleaned periodically because too much dirt on the window can cause it to malfunction.

6.0 PARTS LISTING

The purpose of Section 7 is to provide parts information for the disassembly, repair, replacement, and reassembly of the equipment reflecting the maintenance philosophy. Not all possible spare parts are listed for all variations of the FlashGuard series units.

Description	Part Number	Ref. Designator
Flashhead		
Flashtube Assembly	12S00602	FT1, FT2
Holder, Flashtube	77-4026	
Switch, FH Interlock	77-2644	S1
Transformer, Trigger, White	77-4040W	T1
Transformer, Trigger, Red	77-4040R	T2
O-Ring, Upper	AS568A-383	N/A
O-Ring, Lower	AS568A-380	N/A
Power Supply		
Capacitor, 70μF	CA706A441EK	C2A-F
Capacitor, 4μF	77-3911	C3
Capacitor, 7μF	CA505B661CDG	C1
Fuse, 6A (120VAC)	77-1167	F1
Fuse, 4A (220VAC, 50/60 Hz)	DP-1020	F1, F2
Fuse, 2A (480VAC, 50/60 Hz)	DP-1021	F1, F2
Fuse, 6A (Sidelight Fuse)	77-1167	F3
Fuse, 630mA SB	DP-1019	T1-F1
PCB, Diode	277-3939	-----
PCB, High Voltage	277-3937	-----
PCB, Sync/ Monitor	277-4163	-----
PCB, Trigger/ Control	277-5014-003	-----
PCB, Motherboard	277-5016-001	-----
Relay	77-2013	K1, K2
Relay, Mother Board	KA025DC10S2N	K3
Relay, Sidelight Power	KA121AV0522C	K4

Power Supply (cont'd.)		
Sidelight Level(s) Alarm Card (Incandescent Lamps only)	B7C23PAA	AC
Sidelight Level(s) Alarm Card (LED Fixtures only)	B7C23LAA-001	AC
IC, Voltage Comparator	XZLM111	AC-U1
IC, Quad NAND Gate	XZ14011BCL	AC-U4
IC, Inverter Buffer	XZ14049UBAL	AC-U5
Resistor, 20Ω, 40W	77-2759	R2, R3, R4
Resistor, 1.5kΩ, 50W	40000683-001	R5
Resistor, 50kΩ, 50W	RW50RB0502GF	R6, R7
Resistor, 50Ω, 55W	RW50RB0500GF	R1
Transformer, 120/240V, 60Hz	77-5002	T1
Transformer, 240/480V, 60Hz	77-5066	T1
Transformer, 240/480V, 50Hz	77-5067	T1
Transformer, Current Sensing	40000679-001	T2
Interlock Switch Assembly	40000676-001	-----
Cable, Interconnect	77-4017-4	-----
Single-pole double-throw relay	12E00045-002	-----
GPS		
GPS Sync Unit	40002075-001	-----
GPS Sync Unit Cable, 25 ft	40002074-001	-----
GPS Sync Unit Cable, 50 ft	40002074-002	-----
GPS Sync Unit Cable, 100 ft	40002074-003	-----
GPS Sync Unit Cable, 150 ft	40002074-004	-----
GPS Sync Unit Cable, 350 ft	40002074-005	-----
Bracket, Pole-Mount	40002082-001	
GPS Connector Assembly (Internal to Power Supply)	SMISC230	-----
Photocell		
Photocell (Red Night Only)	77-3258-001	-----
Photocell (White or Dual Lighting Systems)	77-3259-001	-----